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MORTALITY FROM CONSUMPTION IN OCCUPATIONS EXPOSING
TO MUNICIPAL AND GENERAL ORGANIC DUST.

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INTRODUCTION.

The mortality from consumption is known to be very much greater among persons employed in the so-called dusty trades than among those who work in the open air, or under otherwise more sanitary and favorable conditions affecting health and life. To clearly emphasize this important fact, of vital interest to millions of wage-earners employed in more or less dusty trades, it is only necessary to call attention to the material difference in the consumption death rate of certain well-defined employments, where there can be no reasonable doubt that the conclusions are not invalidated by possible serious statistical errors. Thus, for illustration, one of the most dust-exposing occupations is that of the marble and stone cutter, and in this employment, according to the Twelfth Census, the death rate from consumption was 5.41 per 1,000; while, in contrast, among farmers, planters, and farm laborers the death rate from this disease was only 1.12 per 1,000, and among lumbermen and raftsmen, only 1.07 per 1,000. So marked a difference as this must have an essential cause, far more profound than mere differences in social or economic conditions, and foremost of the causes responsible for the excessive mortality from consumption is the more or less considerable inhalation of dust produced during necessary mechanical and industrial processes. Such dust, by its mechanical properties, causes specific injury to the lungs and the delicate membranes of the air passages, where, by its pathogenic properties, direct disease infection is introduced into the human system, often with disastrous consequences to health and life. Naturally the destructive effects of dust must vary according to its quality and mechanical properties, and so much so is this the case that metallic dust is unquestionably the most injurious, while organic dust of animal origin is probably the least harmful. In

an article in Bulletin No. 79 the writer quite fully discussed the general problem of dust pathology and symptomatology, preliminary to a discussion in detail of the degree of consumption frequency in some 42 specific trades and occupations with exposure to metallic, mineral, vegetable fiber, and animal and mixed fiber dust. The present discussion includes 4 additional occupations with exposure to municipal or street dust and 15 with exposure to general organic dust.

The effects of dust on human beings depend, first, upon the amount of dust; second, the kind of dust; third, the constancy of its presence; fourth, the susceptibility of the individual; and, fifth, the method employed to protect the individual against the entrance of dust into the human organism. By rational methods of factory hygiene, chiefly effective in dust removal at the point of origin, the dust nuisance in industrial establishments can be materially reduced, with most beneficial consequences to the health of the persons employed. While much progress has been made in factory sanitation, the evidence is entirely conclusive that present conditions affecting health and life in industry are still very far from what they should be.

The evidence regarding the excessive mortality from consumption in certain dusty trades is so overwhelmingly conclusive that there can be little doubt that the degree of consumption frequency in industry is in almost exact proportion to the amount of dust inhalation, with due regard, of course, to the varieties of dust, which vary according to mechanical, pathogenic, and other properties. While the foregoing conclusion has been an accepted theory of preventive medicine for many years, it is only within comparatively recent times that it has been recognized as a governing principle in the rational administration of sanitary and factory laws. Much importance is conceded to the disposal of industrial and domestic dust as a branch of sanitary work. According to one writer dust may be a threefold factor in pulmonary tuberculosis, because, "First, it may act as a predisposing cause, as a direct physical irritant to the respiratory passages, thus inflaming the mucous membranes and weakening their resistance to bacillary invasion; second, it may carry infection directly by means of dried, fresh tubercular sputum that some ignorant or careless consumptive has recently expectorated; third, it may aggravate tuberculosis by converting an incipient and curable case into one of rapid and virulent destruction of lung tissue because of the addition of pus-producing germs."^a

Concerning the effects of dust on the human organism, another writer has observed that—

Statistical data showed definitely that patients the subjects of pneumoconiosis were especially prone to attacks of acute bronchitis,

^a "The prevention of tuberculosis," by Dr. H. S. Anders, *Pennsylvania Medical Journal*, January, 1906, Vol. IX, No. 4, p. 247.

to pneumonia, and all other forms of pulmonary infection, and especially to pulmonary tuberculosis, as stated by many observers, notable among them was Merkel. Added to these changes in the lung tissue, which have at the same time decreased its functionable possibilities and lowered its resistance against secondary processes, there were great deposits of dust in the lymph nodes. They found these nodes increased in size and black with the dust contained therein. When one considered the important rôle which these glands played in the protection of the body from pathogenic organism which entered through the respiratory tract, one could well appreciate the reason why in these cases lymphoid tuberculosis was the rule. He had found tuberculous lesions almost universally present when pneumoconiosis had brought about this condition in the lymph nodes, and in New York City they might be looked upon as constantly associated lesions.^(a)

The term pneumoconiosis, as here used, is the general name for lung affections resulting from deposits of dust in the lungs and air passages. The term is modified according to the various kinds of dust, and where the deposit in the lungs is coal dust the pathological lesions are called anthracosis; where the deposits are of metallic dust, siderosis; where the deposit is of stone dust, chalicosis, or silicosis; and where the deposit is of fine cotton particles, or vegetable fiber dust, the term byssinosis is used.

Since modern medical research has made it apparent that pathogenic micro-organisms or specific bacilli of infectious diseases are not, as a rule, to any considerable extent conveyed by industrial dust, it is evident that the observed injurious consequences of dust inhalation are largely because of the mechanical properties of the dust itself and the injury it does to the lungs. It is because of this fact that the lung diseases of workmen exposed to industrial dust are specifically defined as pneumoconiosis, or, according to Oliver, industrial lung disease, which in its symptoms and course differs from ordinary tuberculosis, being generally more specifically defined by writers on the diseases of occupation as fibroid phthisis.

In regard to this aspect of the industrial dust problem, it was stated in the address above referred to that—

It seemed that the dangerous quality of inhaled dust lay chiefly in two characteristics, one on the physical character of dust, the other on its organic nature. With very finely comminuted and light dust the resultant lesions of the lungs were much more innocent and secondary pulmonary diseases were much less frequent as a result. On the contrary, [with] dust which contained sharp pointed and jagged particles, inflammatory and irritative changes were much more constant and diffuse and secondary infections, as with tuberculosis, were much more frequent. Dust which was chiefly injurious on account of its organic character was such as contained organisms or organic ma-

^aAddress of Dr. Harlow Brooks, *The Medical Record*, November 23, 1907, p. 878.

terial which were prone to excite disease in the body, as the dried sputa of tuberculous subjects. Other infections so transmitted were those of anthrax, glanders, diphtheria, actinomycosis, and bubonic plague. Obviously the dust which was most detrimental of all to the human body was one which combined the characteristics of both classes.^(a)

In summarizing his conclusions the writer just quoted held—first, that dust in itself was productive of serious disease conditions, particularly of the respiratory and digestive tracts; second, that these primary conditions predispose to secondary lesions, particularly to pulmonary and lymphatic tuberculosis; third, that many contagious and infectious diseases were transmitted through the agency of dust; fourth, that in a city the size of New York, or in large cities generally, the production of large quantities of dust, often of a highly dangerous character, could not be prevented; but, fifth, that such dust could in most instances be relatively and economically collected and disposed of, and the production of unnecessary dust could be and should be prevented by properly framed and enforced regulations.

The foregoing observations in large part refer to the problem of municipal or street dust, which primarily affects men engaged in street cleaning and refuse collection, drivers and teamsters, hackmen and cabmen, street railway employees, letter carriers, etc. In all of these occupations the health-injurious consequences of municipal dust are materially minimized by outdoor life, fresh air, and sunlight, the last named being the most effective agency in the destruction of the pathogenic qualities of municipal dust. The investigations of C. J. Lewis, however, seem to prove that under given conditions of meteorology the number of pathogenic bacteria in municipal dust may be very high, while under opposite conditions the proportion may be very low. Densely populated districts, refuse heaps, and polluted soils, according to this authority, have a marked influence upon the number and character of the pathogenic bacteria in the atmosphere.

The problem of dust prevention on streets and highways, especially since the introduction of the automobile, has attracted wide attention, and, among other results, led to the publication of a circular on experiments with dust preventives by the United States Department of Agriculture in 1908.^(b) The experiments reported upon seem to confirm the belief that it is entirely practicable to materially reduce the dust nuisance on public highways, and to fully confirm the ex-

^a Address of Dr. Harlow Brooks, *The Medical Record*, November 23, 1907, p. 878.

^b See Progress Reports of Experiments with Dust Preventives, Circular No. 89, Office of Public Roads, United States Department of Agriculture, April 20, 1908.

periments of Guglielminetti, who, at the Congress of Climatotherapy and Urban Hygiene, held in Nice, France, in 1907, presented evidence to prove that the application of crude oil to roadbeds was not only comparatively inexpensive, but that it rendered the roads more resistant and diminished cost of repairs, with practically an entire suppression of dust. Upon the same subject Dr. P. Boobbyer, of Nottingham, in an address before the Royal Sanitary Institute Congress, in 1906, made a strong argument in favor of street pavements of smooth material and more effective regulations governing the disposition of refuse and the sweeping of house dust into the streets. Effective sanitary regulations governing street-cleaning methods and refuse disposal must necessarily exert a decided beneficial influence upon the health of the large body of men who, in the pursuit of their respective callings, spend most of their lives on the public streets and highways, while at the same time they must also prove of vast benefit to the public at large.

Of equal importance in this connection brief mention may be made of the sanitary dangers of the vast quantities of dust produced in the demolition of buildings, often old and insanitary premises, through which dust and disease germs inimical to health are disseminated, primarily to the injury of the workmen employed in house-wrecking undertakings. Mention may also be made of the regulations of the London County Council, which decrees that the time for such work in London shall be restricted to between the hours of 6 o'clock in the evening and 10 o'clock in the morning, and it is made incumbent on those responsible for the work of demolition to order that the walls be thoroughly watered during the process. Since most of the labor employed in the demolition of buildings is usually of a casual nature, the health-injurious effects are not, of course, as serious as they would be if the occupation were carried on continuously.

OCCUPATIONS WITH EXPOSURE TO MUNICIPAL DUST.

STREET CLEANING AND REFUSE DISPOSAL.

The number of persons employed in the United States in street cleaning and refuse disposal is unknown, but it may be approximately estimated for the large cities on the basis of the known number of persons employed in the city of New York. A return has been published for Greater New York for the year 1904, according to which the number of persons employed in the street-cleaning department was 4,625, of which 2,686 were sweepers, 1,262 were drivers, and the remainder supervising officials and general laborers.^(a) If the ratio

^a Circular issued by the New York Department of Street Cleaning, May 13, 1904.

of persons employed for street-cleaning purposes to the estimated population of Greater New York holds good for the estimated aggregate population of large American cities, or such as in 1900 had 25,000 inhabitants and over, the approximate number employed in 1909 is 30,000. Of this large number of most useful and, in fact, indispensable workers about 58.1 per cent are sweepers, whose employment predisposes particularly and continuously to the inhalation of more or less injurious dust, largely inorganic, but partly organic, and which, because of its peculiar and characteristic composition, has been defined as municipal dust. In the nature of the employment the exposure must vary in exact proportion as methods for previous street watering are in use, but in most cities at the present time such precautions are generally neglected.

Street sweepers often include a very considerable proportion of old men who have become incapacitated for other forms of labor, but the tendency in our large cities at least is to eliminate this element as not adapted to the requirements of economical municipal administration, and an increasing proportion of men are employed at an age period of much greater susceptibility to disease infection than in the case of the old, who, in a measure, represent the survival of a type more or less immune. In an address on the insanitary condition of London streets, it was stated with reference to this aspect of the problem that—

While in the main streets, where work goes on while the traffic is running, it is necessary to have men with all their faculties and full physical power to do the work, at the same time that they are keeping watch against the dangers in which they work; yet in the quiet streets of little traffic it is a class of labor upon which aged and less capable men can very well be employed, and are better so employed even at a lower wage than turned adrift to become chargeable to the poor rate.^(a)

The evils incident to crude methods of street cleaning and refuse disposal were early recognized by Ramazzini, who, in 1670, held that men employed on the roads were subject to disorders of the digestive organs and generally suffered greatly from epidemics. This early view of an extremely careful observer of actual conditions and their consequences is curiously enough confirmed by the opinion of to-day as expressed by Professor Sedgwick, that atmospheric dust must be included in the causes responsible for the spread of typhoid fever.^(b)

Halford, a German authority, writing in 1845, held that street cleaners suffered as the result of inhaling street dust and in consequence of exposure to more or less dangerous emanations. Hirt, in

^aAddress of W. N. Blair, Transactions of the Sanitary Institute, 1900, p. 292.

^bReport of Pittsburg Filtration Commission, January, 1899, p. 12.

his treatise on *The Diseases of Workmen*, with special reference to dusty trades, sustains this view and refers to the earlier observations of Sonnenkalb and Chrastina, who had reported upon the health-injurious consequences of the street dust of Leipzig and Vienna. Hirt calls attention to the wide degree of divergence in the character of municipal dust in different localities materially influenced, of course, by the materials used in road construction. These early writers gave more attention to the inorganic dust particles than to the organic elements, and writing as they did before the discovery of the bacilli of tuberculosis the seriously infectious character of street dust under certain favorable conditions escaped their attention. More recently—

some very suggestive facts have been published regarding the prevalence of tuberculosis among street cleaners of Greater New York. It was ascertained, according to published reports, that about one-third of the 5,000 street cleaners were infected with tuberculosis. This startling discovery was emphasized by the statement that every employee had, previous to his employment, been examined by civil service physicians and pronounced free from organic disease. It was also disclosed by the investigation that on the west side, where the streets were wider and better kept, the force was less liable to illness than on the east side, where the streets were more dirty and where diseases of the nose, throat, and lungs were more common. Contrasts were drawn between the conditions in Berlin and Greater New York, and it was held that in the former city the street-cleaning force was quite healthy and free from tubercular diseases, the street cleaning force in Greater New York was particularly liable to this disease, chiefly on account of the fact that the dust was collected, in many cases, without the street having been previously sprinkled. The introduction of the modern system of street-cleaning machines, removing the dust under cover, and performing at the same time sprinkling, cleaning, and dumping processes, is a much-to-be-desired improvement, which is certain to have a beneficial effect upon the health of the street-cleaning force.^(a)

The mortality from tuberculosis among street cleaners of New York City has also been discussed in an extended article in the *New York Medical Journal* for 1904, from which the following extracts are made as perhaps the most authoritative expression of medical opinion regarding the health-injurious aspects of this employment available at the present time:

It has been stated that five years' work as a street cleaner of New York makes the average individual a consumptive. When we consider that every employee in the street-cleaning department must be carefully examined and found to be in perfect health before being admitted into the service; when we further consider that street cleaning is an outdoor occupation, and, lastly, that in European cities, as, for example, in Berlin, the street sweepers show the smallest mor-

^a The Medical Examiner and General Practitioner, December, 1907, pp. 361, 362.

bidity and mortality from tuberculosis and other diseases among that city's laboring population, the medical profession may well ask itself why conditions are so different in New York.

To the close observer it is not difficult to find an explanation. In well regulated European cities the streets are frequently sprinkled before they are swept; here the sweeping is almost invariably done dry. Now, it is not the tubercle bacillus alone which renders our street cleaners consumptive, but it is the constant inhalation of all kinds of dust and the consequent irritation of the pulmonary surfaces, which make the invasion of the germ of tuberculosis more easy. The sweeping of streets in the dry state should be considered as a crime against our fellow-men. It is not the air, but the dust in the air, which renders New York such a dangerous place, particularly in summer, to people predisposed to pulmonary troubles. While, as a natural consequence of being in closer proximity to the dust, the street cleaners are the first to suffer, the citizens at large who are obliged to remain in New York during the summer months suffer also to a considerable degree.

* * * No street should be swept without being previously sprinkled, and the gutters in the streets should be flushed daily, except in freezing weather. To forbid people to spit altogether when outdoors is unreasonable and any such law would not be carried out, but a law could be enforced which made spitting in the gutter permissible, but expectorating on the sidewalk and in the middle of the street punishable by a severe fine. Besides all these precautions, street cleaners could be provided with respiratory masks as an additional protection, particularly in very dusty localities.^(a)

The same subject has been considered from a different point of view in an address on street dust and public health, delivered before the New York Academy of Medicine, April 4, 1907, in which attention was called to the fact that even where the immediate infection by the bacillus tuberculosis might not lead to the disease the inhalation of street dust might easily develop a catarrh which would make a previously existing tuberculosis fatal. In reference to the health-injurious character of street dust it was stated that—

When thus atomized and inhaled it acts injuriously upon all the sensitive mucous membranes of the respiratory passages, partly through mechanical irritation and trauma and partly by conveying to them and imbedding in their folds a great variety of germs. These germs are not necessarily those of specific diseases such as the pneumococcus or bacillus tuberculosis, for such germs are known to be killed by conditions of prolonged exposure to dryness and sunlight, whereas moisture proves favorable to their longevity. But sufficient nonspecific germs are conveyed by street dust to excite catarrhal or purulent inflammations, and by thus fostering a chronically diseased or irritated condition of the respiratory passages, the latter are rendered liable to more serious infections. Herein lies the chief menace to health from street dirt. The danger is complicated

^a New York Medical Journal, May 14, 1904, pp. 937, 938.

by the fact that the sputum of patients having chronic tuberculosis, bronchitis, or nasopharyngeal catarrh, expectorated when they are at large in the streets, is swept from the sidewalks and added to the general street dirt.^(a)

The foregoing conclusions apply with particular force to street cleaners, who are continuously exposed to the risk of dust inhalation, and most so, of course, where previous street sprinkling is not practiced.^(b) In consequence of such exposure there is a decided increase in the liability to tuberculosis and other respiratory diseases, chiefly pneumonia, which modern medical research has clearly proven to be an infectious disease. Other factors, no doubt, complicate the problem, and among these mention may be made of the liability to overstrain on the part of refuse collectors or ashmen, who often suffer from injuries received from lifting heavy barrels, so much so that any given street-cleaning force has continuously a number of men laid off or on half pay on this account. Diminished disease resistance under conditions like the foregoing necessarily increases the liability to tubercular or other infection.

Street cleaning and the disposal of city refuse require, in other words, to be considered as an extremely important and highly complex proposition, demanding the highest administrative skill for its practical solution. Street sweeping by machines is gradually replacing sweeping by hand—that is, in most of the principal thoroughfares of our large cities; but progress in even this direction is much slower than the needs of the situation demand.^(c)

The health-injurious consequences of street dust have been summed up in a discussion of the address of Dr. W. G. Thompson, previously referred to, in which it was stated that “to sweep a street when it was dry was a crime against one’s fellow-men. It was a mistaken idea to think that dust which did not contain pathogenic, i. e., specific disease-producing, micro-organisms was harmless. It was, on the contrary, most harmful, because of its irritating influence on the mucous membranes of the respiratory organs.” The speaker referred to the relative increase in tuberculosis among the street sweepers of the city of

^a “Street dirt and public health,” by W. Gilman Thompson, M. D., New York Medical Journal, April 20, 1907, p. 725.

^b For a discussion of the problem of municipal dust, a treatise on Dust and Its Dangers, by T. M. Prudden, M. D., New York, 1907, chapter 9, may be consulted.

^c The problem of city refuse and its disposal as a metropolitan problem has been discussed by Mr. H. D. Parsons in the Scientific American Supplement of July 4, 1908, while a new system of street cleaning and a sanitary street cleaner is described in the Scientific American for May 10, 1902. An earlier descriptive account of machines for sprinkling and sweeping streets appeared in the Scientific American Supplement of March 24, 1888.

New York, which had first been noticed a few years ago, and which, in his opinion, "was not solely due to the inhalation of tuberculous sputum which might have been expectorated in the streets by consumptives and which had most likely been rendered innocuous by sunlight and air," but the increase "was due to the irritating influence of dry dust raised by the street sweepers themselves," because the streets were not sprinkled previously to the sweeping process. He concluded his remarks with the statement that—

The pulmonary tissue thus irritated invited an invasion of the bacilli to which the street cleaner, in his unsanitary tenements and other unhygienic environments, was as much exposed as anybody else. When the streets were sprinkled before they were swept there would be less tuberculosis among the street cleaners. As proof of all this he cited the well-known fact that the street cleaners of Berlin were the healthiest body of men of all the city's employees and virtually free from tuberculosis.^(a)

There are no American official vital statistics of persons employed in street cleaning and refuse disposal, nor have the statistics of the large street-cleaning departments of the principal cities been made public otherwise than in the report in 1904 by J. M. Woodbury, as street-cleaning commissioner of the city of New York. The industrial insurance mortality statistics for men in this group of employments for the period 1897 to 1906 include 180 recorded deaths, of which 33, or 18.3 per cent, were from consumption. Of the mortality of street cleaners from respiratory diseases other than consumption, 23 were from pneumonia, 8 from asthma and bronchitis, and 2 from other diseases in this group, a total of 33, or 18.3 per cent. If the deaths from consumption and from other respiratory diseases are combined, 36.7 per cent of the mortality of street cleaners was from diseases of the lungs and air passages. It is evident from the foregoing statistics that the recorded mortality from consumption among men in this employment is not decidedly excessive, but it must be clearly kept in mind that there is probably no occupation more subject to changes and from which the physically impaired are more rigidly excluded by occupation selection than in the street-cleaning and refuse-disposal service of large cities. The table which follows states in detail the consumption mortality of street cleaners by divisional periods of life, with the comparative proportionate mortality of the general population in the United States registration area during the period 1900 to 1906:

^a Discussion by Dr. S. A. Knopf, Medical Record, April 27, 1907, pp. 705, 706.

PROPORTIONATE MORTALITY FROM CONSUMPTION AMONG STREET CLEANERS, 1897 TO 1906, COMPARED WITH THAT OF ALL MALES IN THE REGISTRATION AREA OF THE UNITED STATES, 1900 TO 1906, BY AGE GROUPS.

Figures for street cleaners from experience of an industrial insurance company; figures for males in registration area computed from mortality statistics of the United States census.]

Age at death.	Deaths of street cleaners, 1897 to 1906, due to—		Per cent of deaths due to consumption among—	
	All causes.	Consumption.	Street cleaners.	Males in registration area, 1900 to 1906.
5 to 24 years.....				27.8
5 to 34 years.....	18	8	44.4	31.3
5 to 44 years.....	37	13	35.1	23.6
5 to 54 years.....	47	7	14.9	15.0
5 to 64 years.....	45	3	6.7	8.1
5 years and over.....	33	2	6.1	2.7
Total.....	180	33	18.3	14.8

While the preceding statistical data are not entirely conclusive, they would seem to confirm the conclusion, when taken in connection with the foregoing observations, based on a careful consideration of all the available facts and conditions, that street cleaners as a class are subject to health-injurious circumstances connected with their employment, and that the exposure to dust inhalation results in a comparatively high degree of consumption frequency at ages 25 to 44, inclusive.

DRIVERS AND TEAMSTERS.

Drivers and teamsters, perhaps more than any other class of outdoor workmen, are exposed to the risk of considerable and continuous inhalation of municipal dust. By reason of the usual position of the driver's seat, perhaps 8 feet or more above the ground, the degree of direct exposure is, however, much less than in the case of street sweepers and refuse collectors. The wages of drivers and teamsters are, as a rule, rather low, and the hours of labor are often both long and uncertain. Drivers and teamsters are under the further disadvantage of having to sit in a fixed position for many hours at a time, and in addition night work may be named as probably one of the factors detrimental to the health of men employed in this occupation. While a large portion of the working time of drivers and teamsters, cabmen and coachmen, etc., is spent out of doors, a not inconsiderable length of time is spent in stables, the air of which is usually more or less foul and polluted. A fair proportion of cabmen and teamsters work at night, and their working hours are irregular, with a constant temptation to dissipation. Finally, it is to be considered that the occupation of cabman or teamster does not require

a long apprenticeship or any special skill, and that the occupation often is recruited from many of the failures in other employments.

Thackrah (1832) refers to cart drivers as those exposed to atmospheric vicissitudes, but as being "healthy in proportion to their temperance and the nourishment they take." He remarks that "their wages, however, are low; they are often indifferently fed; and many, particularly among the coal leaders, congregate and spend at the alehouse that money which would be better employed in buying solid food."^(a)

The mortality in this group of employments is briefly discussed by Dr. Jacques Bertillon, from whose address on the "Morbidity and mortality according to occupation," as translated for the Journal of the Royal Statistical Society, the following is quoted:

Coachmen, wagoners, draymen are subject to a very high mortality to which it may be well to devote a little attention. In England coachmen, cabmen (not domestics) are distinguished from carmen, carriers, carters, draymen. In both the death rate is so high, that the occupation may be considered one of the most unhealthy in the country. Of the two that of the coachmen is the worst (the domestic coachman is excluded, for he enjoys very good health), probably because he is obliged to remain on his seat in all weathers and seasons, while the wagoner can walk by his horses and thus keep himself warm. At Paris, similar results are found. Either occupation has a great mortality, but the cabmen are worse off than the carmen and draymen, whose rate even becomes normal after 50. The English statistics teach us the causes of death among this class. Their digestive organs are in good condition, but all the other organs are constantly attacked. As might be expected, the respiratory organs are most often diseased. Phthisis is very common; alcoholism is enormously developed, and in its train follow diseases of the liver, urinary organs, nervous and circulatory systems. Gout is very frequent, and deaths from accidents exceed the average. In Switzerland "carting and driving" give rise to a mortality almost double the average. Phthisis is not the principal factor, for up to 30 years of age it is unusual rather than otherwise among the Swiss coachmen and wagoners; above this age it is over the average, but without reaching anything like the high level we found among stone masons, locksmiths, and watchmakers, for example. Although the occupation of coachmen is evidently unhealthy (and it should be noted that a man must be strong and muscular to harness and groom horses, and that selection would tend to diminish the mortality peculiar to this profession), the Italian sickness tables assign to them but few days of illness while they are young. It is only after 45 that their morbidity is above the average to any great extent. The English consider "horsekeepers, grooms, jockeys" separately; their death rate is identically the same as that of the coachmen, i. e., is very high.^(b)

^a The Effects of Arts, Trades, and Professions on Health and Longevity, by C. Turner Thackrah, 1832, pp. 13, 14.

^b Journal of the Royal Statistical Society, 1892, p. 581.

Arlidge, in his treatise on the diseases of occupations, considers the entire group of drivers and teamsters, including drivers of public vehicles—cab, omnibus, and tram-car men, carriers and carters—at some length, holding that they form a class of occupied people having as a common character the carriage of persons and goods with more or less exposure to weather. But “the differences in health conditions outnumber the points of similarity; for the former are almost as many as are the individuals occupied in the business.” He continues:

In great cities like London, the drivers of omnibuses and cabs form a large fraternity, subjected to special police regulations, held together by the bonds of a common employment, and by voluntary associations. They suffer from long and often late hours, from exposure to the inclemencies of weather, and to many hardships and annoyances. They are recruited from the list of private coachmen and grooms, and to no small extent from the prodigals and the good-for-nothing born to superior positions. Among them, as a body, intemperance prevails widely, along with its frequent accompaniment, dissolute living. Their abodes are frequently unhealthy, not uncommonly situated in confined and ill-ventilated yards, and placed above the stables. In short, they are surrounded by a host of insanitary conditions, and, as a result, suffer the consequences of such; furthermore, they have more than their share of accidents.^(a)

After stating that the comparative mortality figure of this group of employments is surpassed by only five other occupations in English experience, Arlidge states that the mortality from consumption was as 359 among drivers and teamsters to 220 in other occupations; the mortality from nervous diseases was as 134 to 119; the mortality from diseases of circulation was as 160 to 120; the mortality from respiratory maladies as 341 to 182; from urinary diseases as 65 to 41; hepatic diseases as 54 to 39; alcoholism as 33 to 10; gout as 11 to 3; and accidents as 84 to 67.

Thomas Oliver, in his discussion of the mortality of drivers of public vehicles, observes that men in this group of employments “suffer and become prematurely old in consequence of their exposure to inclement weather, late hours, and irregularity in getting their meals. Alcoholism and exposure to cold are responsible for their tendency to develop gout and rheumatism, and through these disorders to secondary affections of the kidneys, heart, and respiratory organs. They die at the rate of 1,482 to 1,000 of the male population generally.”^(b)

The foregoing observations are confirmed by the United States census of 1890, according to which the mortality of draymen, hack-

^a Diseases of Occupations, by J. T. Arlidge, p. 127.

^b Dangerous Trades, by Thomas Oliver, p. 798.

men, teamsters, drivers, etc., in the registration States was materially in excess of the corresponding mortality of occupied males generally. Comparing the mortality of this group, however, with the mortality of men employed in agriculture, transportation, and other outdoor occupations, it appears that while the average mortality rate of this class at ages 15 to 24 was 4.13 per 1,000, the death rate for draymen, hackmen, etc., was 6.47; at ages 25 to 44 the respective death rates were 5.88 and 11.07; at ages 45 to 64 the rates were 11.54 and 19.39, respectively; and at ages 65 and over the rates were 59.31 and 63.23. As observed in the census report, the death rates of draymen, hackmen, teamsters, etc., were higher in each age group than the average rate for occupations of this class, and an analysis of the causes of death proves that the most prominent among this class were consumption and respiratory diseases. The mortality from consumption of draymen, hackmen, etc., was 304 per 100,000, against 162 for persons employed in agriculture, transportation, and other outdoor occupations. The corresponding death rates for respiratory diseases were 237 and 192, respectively.^(a)

The mortality from consumption among draymen, hackmen, etc., was highest in the cities, or 363 per 100,000 living, while in the rural districts it was only 105 per 100,000. There was the same marked difference in the mortality from respiratory diseases, which was 281 per 100,000 in the cities and only 89 in the rural districts.^(a)

The foregoing facts are in entire conformity to English experience and would seem to warrant the conclusion that the exposure to municipal dust on the part of drivers and teamsters in cities is at least one of the predisposing causes of their high mortality from consumption and respiratory diseases.

The number of drivers and teamsters in the United States, according to the census report on occupations for 1900, was 532,637, and of this number 10,777, or 2.0 per cent, were 65 years of age and over, which compares with 4.7 per cent for the entire male population of the continental United States. At ages 55 to 64 the proportion was 5.7 per cent, and at ages 45 to 54, 12.8 per cent, leaving 79.5 per cent at ages 15 to 44, inclusive. The occupation was briefly considered in the vital statistics of the census of 1900, but it is evident that the returns are not entirely trustworthy, in any event not for ages 45 and over. At ages 15 to 24 the mortality from all causes in the registration States in 1900 was 4.7 per 1,000, which compares with 4.4 for the manufacturing and mechanical class, and 2.6 for the mercantile and trading class. At ages 25 to 44 the death rate of draymen,

^a Report on Vital and Social Statistics, Part I, Eleventh Census of the United States, 1890, pp. 159 and 163.

hackmen, and teamsters was 9.9 per 1,000 in 1900, which compares with 8.4 for the manufacturing and mechanical class and 6.7 for the mercantile and trading class. The mortality from consumption is not returned by divisional periods of life, but is given in the aggregate for all ages as 2.6 per 1,000 in 1900, which compares with 2.6 per 1,000 for the manufacturing and mechanical class, and 1.7 per 1,000 for the mercantile and trading class. The mortality from other respiratory diseases was 1.7 per 1,000 in 1900, which is also rather high, especially so in view of the fact that the proportion of draymen, hackmen, and teamsters at advanced ages was comparatively small.

The vital statistics of this group of occupations, according to the census of 1900, are inconclusive, as were those of 1890, and the death rate from all causes is somewhat lower at all ages except 65 and over. The mortality from consumption at ages 15 and over for drivers, hackmen, and teamsters was ascertained to be 2.6 per 1,000 in 1900, against 3.0 per 1,000 for the census year 1890, while the mortality from respiratory diseases other than consumption was ascertained to be 1.7 per 1,000 in 1900, against 2.4 for the census year 1890.

The recorded industrial insurance mortality statistics of drivers and teamsters include 3,850 deaths, of which 999, or 25.9 per cent, were from consumption. Of the mortality of drivers and teamsters from respiratory diseases other than consumption 483, or 12.5 per cent, were from pneumonia; 27, or 0.7 per cent, from asthma; 56, or 1.5 per cent, from bronchitis; and 66, or 1.7 per cent, from less frequent respiratory diseases. If the deaths from consumption and from other respiratory diseases are combined, it is found that 42.4 per cent of the mortality of drivers and teamsters was from diseases of the lungs and air passages. The excess in the consumption mortality of drivers and teamsters is still more clearly brought out in the tabular presentation of the proportionate mortality from this disease by divisional periods of life. While the consumption mortality was excessive at all the specified age periods except 55 to 64, the excess was most pronounced at ages 35 to 44, when out of every 100 deaths from all causes 32.1 were from consumption, against a normal expected proportion of 23.6. The analysis of the consumption mortality of drivers and teamsters in detail is set forth in the table following.

PROPORTIONATE MORTALITY FROM CONSUMPTION AMONG **DRIVERS AND TEAMSTERS**, 1897 TO 1906, COMPARED WITH THAT OF ALL MALES IN THE REGISTRATION AREA OF THE UNITED STATES, 1900 TO 1906, BY AGE GROUPS.

[Figures for drivers and teamsters from experience of an industrial insurance company; figures for males in registration area computed from mortality statistics of the United States census.]

Age at death.	Deaths of drivers and teamsters, 1897 to 1906, due to—		Per cent of deaths due to consumption among—	
	All causes.	Consumption.	Drivers and teamsters.	Males in registration area, 1900 to 1906.
15 to 24 years.....	386	126	32.6	27.8
25 to 34 years.....	1,024	400	39.1	31.3
35 to 44 years.....	974	313	32.1	23.6
45 to 54 years.....	660	113	17.1	15.0
55 to 64 years.....	468	35	7.5	8.1
65 years and over.....	338	12	3.6	2.7
Total.....	3,850	999	25.9	14.8

In Rhode Island out of 531 deaths reported during the ten-year period ending with 1906, 131, or 24.7 per cent, were from consumption. Of the mortality from other respiratory diseases there were 63 deaths from pneumonia, or 11.9 per cent, and 14 deaths from asthma, bronchitis, and other respiratory diseases, or 2.7 per cent of the mortality from all causes. Combining the mortality from consumption and from other respiratory diseases gives 39.3 per cent as the mortality of drivers and teamsters in Rhode Island from diseases of the lungs and air passages.

The English occupation mortality statistics for drivers and teamsters are found in part under the titles carmen and carriers, and during the three-year period 1900–1902 included 9,505 deaths from all causes. Of this number of deaths 1,446, or 15.2 per cent, were from consumption; and 1,973, or 20.8 per cent, from respiratory diseases other than consumption. Of the deaths from all causes 3,419, or 36.0 per cent were, therefore, from diseases of the lungs and air passages. In the following table a comparison is made of the mortality from all causes among men employed as carmen and carriers with that of occupied males generally, and the result indicates an excessive mortality at all ages except 20 to 24, when the mortality was slightly below the normal expected rate for all occupied males:

MORTALITY FROM ALL CAUSES AMONG CARMEN AND CARRIERS, COMPARED WITH THAT OF ALL OCCUPIED MALES IN ENGLAND AND WALES, 1900 TO 1902, BY AGE GROUPS.

[From Part II. Supplement to the Sixty-fifth Annual Report of the Registrar-General of Births, Deaths, and Marriages in England and Wales.]

Age at death.	Death rate per 1,000 for all occupied males.	Death rate for carmen and carriers.		
		Rate per 1,000.	Greater (+) or less (-) than rate for all occupied males.	Ratio to rate for all occupied males.
15 to 19 years.....	2.44	2.80	+ 0.36	115
20 to 24 years.....	4.41	4.29	- .12	97
25 to 34 years.....	6.01	6.71	+ .70	111
35 to 44 years.....	10.22	13.09	+ 2.87	128
45 to 54 years.....	17.73	20.42	+ 2.69	115
55 to 64 years.....	31.01	36.46	+ 5.45	118
65 years and over.....	88.39	107.84	+19.45	122

In the table which follows the mortality from consumption and from respiratory diseases other than consumption among men employed as carmen and carriers is compared with the normal mortality for all occupied males from these diseases by divisional periods of life. The comparison shows that the mortality from consumption was slightly below the normal expected at all ages except 35 to 44 and 65 and over. The difference from the normal expected, however, was comparatively small at all ages. The mortality from other respiratory diseases, however, was somewhat excessive at all ages, but the excess was most pronounced at ages 35 and over. The tabular analysis which follows is self-explanatory and requires no further comment:

MORTALITY FROM CONSUMPTION AND FROM OTHER DISEASES OF THE RESPIRATORY SYSTEM AMONG CARMEN AND CARRIERS, COMPARED WITH THAT OF ALL OCCUPIED MALES IN ENGLAND AND WALES, 1900 TO 1902, BY AGE GROUPS.

[From Part II, Supplement to the Sixty-fifth Annual Report of the Registrar-General of Births, Deaths, and Marriages in England and Wales.]

Age at death.	Mortality from consumption.				Mortality from other diseases of the respiratory system.			
	Death rate per 1,000 for all occupied males.	Death rate for carmen and carriers.			Death rate per 1,000 for all occupied males.	Death rate for carmen and carriers.		
		Rate per 1,000.	Greater (+) or less (-) than rate for all occupied males.	Ratio to rate for all occupied males.		Rate per 1,000.	Greater (+) or less (-) than rate for all occupied males.	Ratio to rate for all occupied males.
15 to 19 years.....	0.54	0.49	-0.05	91	0.24	0.26	+0.02	108
20 to 24 years.....	1.55	1.05	- .50	68	.48	.57	+ .09	119
25 to 34 years.....	2.03	1.79	- .24	88	.77	1.15	+ .38	149
35 to 44 years.....	2.74	2.91	+ .17	106	1.66	2.69	+1.03	162
45 to 54 years.....	3.04	2.97	- .07	98	3.32	4.44	+1.12	134
55 to 64 years.....	2.16	1.94	- .22	90	6.54	9.44	+2.90	144
65 years and over.....	1.11	1.47	+ .36	132	17.77	25.54	+7.77	144

COACHMEN, CABMEN, AND MEN EMPLOYED IN OMNIBUS SERVICE.

Coachmen, cabmen, and men employed in omnibus service may properly be separately considered in the group of persons exposed to municipal dust. In the census statistics of the United States these employees are apparently included under the heading of "Drivers, teamsters, and hackmen;" in the English statistics and in the industrial insurance mortality statistics coachmen and cabmen are separately tabulated. The English occupation mortality statistics for men employed as coachmen, cabmen, and in omnibus service are quite conclusive of the injurious effects of these occupations on health, particularly at ages over 25. In the table which follows a comparison is made of the mortality from all causes among men in this group of occupations with occupied males generally, and at ages 25 and over it is shown that the general mortality of this class exceeds the general average by from 0.36 to 7.71 per 1,000:

MORTALITY FROM ALL CAUSES OF COACHMEN, CABMEN, AND MEN IN OMNIBUS SERVICE, COMPARED WITH THAT OF ALL OCCUPIED MALES IN ENGLAND AND WALES, 1900 TO 1902, BY AGE GROUPS.

[From Part II, Supplement to the Sixty-fifth Annual Report of the Registrar-General of Births, Deaths, and Marriages in England and Wales.]

Age at death.	Death rate per 1,000 for all occupied males.	Death rate for coachmen, cabmen, and men in omnibus service.		
		Rate per 1,000.	Greater (+) or less (-) than rate for all occupied males.	Ratio to rate for all occupied males.
15 to 19 years.....	2.44	1.89	-0.55	77
20 to 24 years.....	4.41	3.51	- .90	80
25 to 34 years.....	6.01	6.37	+ .36	106
35 to 44 years.....	10.22	12.51	+2.29	122
45 to 54 years.....	17.73	20.76	+3.03	117
55 to 64 years.....	31.01	34.84	+3.83	112
65 years and over.....	88.39	96.10	+7.71	109

A more extended comparison is made in the next table, in which the mortality of coachmen, cabmen, and omnibus service employees from consumption and from other respiratory diseases is compared with the normal mortality of occupied males from these diseases, by divisional periods of life. The comparison shows that at ages 25 and over the mortality from consumption is excessive except at ages 65 and over. The excess is highest at ages 35 to 64. The table further shows that the mortality from other respiratory diseases is excessive among men in this class at ages 25 and over, the excess ranging from 6 per cent to 24 per cent, or from 0.05 to 4.20 per 1,000. The two tables derived from English experience indicate quite clearly an

excess mortality among men employed as coachmen, cabmen, and in omnibus service from consumption and other respiratory diseases.

MORTALITY FROM CONSUMPTION AND FROM OTHER DISEASES OF THE RESPIRATORY SYSTEM AMONG COACHMEN, CABMEN, AND MEN IN OMNIBUS SERVICE, COMPARED WITH THAT OF ALL OCCUPIED MALES IN ENGLAND AND WALES, 1900 TO 1902, BY AGE GROUPS.

[From Part II, Supplement to the Sixty-fifth Annual Report of the Registrar-General of Births, Deaths, and Marriages in England and Wales.]

Age at death.	Mortality from consumption.				Mortality from other diseases of the respiratory system.			
	Death rate per 1,000 for all occupied males.	Death rate for coachmen, cabmen, and men in omnibus service.			Death rate per 1,000 for all occupied males.	Death rate for coachmen, cabmen, and men in omnibus service.		
		Rate per 1,000.	Greater (+) or less (−) than rate for all occupied males.	Ratio to rate for all occupied males.		Rate per 1,000.	Greater (+) or less (−) than rate for all occupied males.	Ratio to rate for all occupied males.
15 to 19 years.....	0.54	0.47	−0.07	87	0.24	0.17	−0.07	71
20 to 24 years.....	1.55	1.22	−.33	79	.48	.37	−.11	77
25 to 34 years.....	2.03	2.22	+ .19	109	.77	.82	+ .05	106
35 to 44 years.....	2.74	3.58	+ .84	131	1.66	1.97	+ .31	119
45 to 54 years.....	3.04	3.95	+ .91	130	3.32	3.74	+ .42	113
55 to 64 years.....	2.16	2.75	+ .59	127	6.54	7.57	+1.03	116
65 years and over.	1.11	.98	−.13	88	17.77	21.97	+4.20	124

The recorded industrial insurance mortality statistics of coachmen, cabmen, and hackmen include 651 deaths from all causes, of which 163, or 25 per cent, were from consumption. Of the mortality of this class from other respiratory diseases, 94 were from pneumonia, 6 from asthma, 10 from bronchitis, and 12 from less frequent respiratory diseases. When the deaths from consumption and from other respiratory diseases are combined, it is found that 43.8 per cent of the mortality of coachmen, cabmen, and hackmen was from diseases of the lungs and air passages. The excess in the consumption mortality of this class is still more clearly brought out in the tabular presentation of the proportionate mortality from this disease by divisional periods of life. While the consumption mortality was excessive at all ages, the excess was most pronounced at ages 15 to 24, when out of every 100 deaths from all causes, 48.7 were from consumption, against a normal expected proportion of 27.8. The analysis of the consumption mortality of coachmen, cabmen, and hackmen is set forth in detail in the table following.

PROPORTIONATE MORTALITY FROM CONSUMPTION AMONG CABMEN, COACHMEN, AND HACKMEN, 1897 TO 1906, COMPARED WITH THAT OF ALL MALES IN THE REGISTRATION AREA OF THE UNITED STATES, 1900 TO 1906, BY AGE GROUPS.

[Figures for cabmen, coachmen, and hackmen from experience of an industrial insurance company; figures for males in registration area computed from mortality statistics of the United States census.]

Age at death.	Deaths of cabmen, coachmen, and hackmen, 1897 to 1906, due to—		Per cent of deaths due to consumption among—	
	All causes.	Consumption.	Cabmen, coachmen, hackmen.	Males in registration area, 1900 to 1906.
15 to 24 years.....	39	19	48.7	27.8
25 to 34 years.....	136	58	42.6	31.3
35 to 44 years.....	154	52	33.8	23.6
45 to 54 years.....	149	22	14.8	15.0
55 to 64 years.....	105	11	10.5	8.1
65 years and over.....	68	1	1.5	2.7
Total.....	651	163	25.0	14.8

The preceding observations and statistical data fully support the conclusion that men employed as drivers and teamsters, coachmen, cabmen, hackmen, etc., represent employments subject to decidedly health-injurious conditions, which are responsible more or less for the comparatively high degree of consumption frequency in the occupations considered.

SUBWAY EMPLOYEES.

Subways for transportation purposes have been so recently brought into use in the United States that no extensive statistical data are as yet available regarding the health of men employed in the operation of underground railways. The construction of tunnels and subways involves many dangers to health and life, which, however, do not come within the scope of this discussion, which is limited to men employed chiefly in connection with subway transportation. Underground railways differ considerably in construction, and as distinct types mention may be made of the relatively short subway in Boston, the long but fairly spacious subway in New York, and the tubelike freight subway in Chicago. Conditions, no doubt, are at their best where there are large openings connecting the subway with the surface, and at their worst where considerable depth precludes natural ventilation. The complaint is general that the air in subways is polluted and more or less injurious to health and life. Investigations by Dr. C. F. Chandler, tending to prove that the amount of oxygen is sufficient, do not warrant the opinion that there are not other health-injurious conditions present which make subway travel and employment a menace to health and life. The investigations of

Doctor Sutherland, in connection with the operation of the Central London Railway, have shown that while the outside air contained on an average 2.8 parts of carbon dioxide per 10,000 volumes, the interior air of the stations and cars within the tube showed that on the station platforms the proportions varied from 4.2 to 7.4 parts during the hours of moderate travel, and during the business hours the proportion rose from 11.0 to 20.5 parts. Such a proportion of carbon dioxide is held to be in a high degree unhealthy to a strong person, while a much lower proportion can not but be injurious to a person of weakly constitution.^(a)

The most thorough investigation into the sanitary aspects of subway employment has been made by Dr. G. A. Soper, consulting sanitary engineer to the New York City Board of Rapid Transit Commissioners. In an address before the New York Academy of Medicine on March 15, 1906, Doctor Soper considered in detail the whole subject of the condition of the air of the New York subway, observing, with particular reference to the dust problem, that—

The dust of the subway was made the subject of special study from chemical, physical, and biological standpoints. Chemical analyses of the dust showed that it contained 61.30 per cent of iron, nearly all of which was in the metallic state. There were also 21.94 per cent of organic matter, consisting of particles of animal and vegetable origin, 15.58 per cent of silica and other matters insoluble in acid, and 1.18 per cent of oil. The average of a considerable number of determinations of the weight of dust suspended in the air was 61.6 milligrams per thousand cubic feet of air. The maximum weight was 204 milligrams. Twenty-three comparative tests were made to determine, with particular care, the weight of dust in the air of the subway and in that of the streets at the same time, and as near the same places as possible. These showed an excess in the subway over the outside air averaging 47 per cent. In eighteen cases, the weight of dust in the subway air over that in the air of the streets ranged from 11 to 800 per cent.^(b)

Doctor Soper explained that the origin of a large part of the subway dust was readily traceable to the air currents from the streets and to the movement of passengers. Some of the dust, he held, was produced in the subway by the gradual wear and tear of wood and cement and other materials of construction, but a considerable amount of the dust was pulverized metal, ground up by the operation of the trains. In conclusion he said:

It has been demonstrated that the metal in the air is chiefly cast iron derived from the grinding of the powerful brakes of the cars. It is a matter of official information that the loss in weight of the brake shoes, which are the principal wearing surfaces, has amounted

^a See New York Medical Record, February 14, 1903, p. 259.

^b New York Medical Record, April 21, 1906, p. 614.

to one ton per mile per month. In addition, the wheels themselves and the tracks are being constantly ground up, especially at the curves.

It must not be supposed that the great aggregate weight of metal which these figures indicate is wholly converted into dust and mingled with the subway air which is breathed by the average traveler. Many of the iron particles are too large and too heavy to be carried far, even by the strongest draughts of the moving trains. Many bits of smaller size, after being whirled about for a brief period, settle upon the oily tracks or fall into the voids in the broken stone ballast and are so retained. Only a portion of the finer particles find their way into the general atmosphere of the subway and are kept afloat by draughts.

At the same time, it is needless to point out to a body of physicians the significance which attaches to the presence of a large amount of finely divided metallic iron in the air. All text-books of hygiene, of pathology, and of medicine describe them under the terms of siderosis, pneumoconiosis, fibroid phthisis, and grinders' rot.^(a)

The foregoing observations of a thoroughly qualified expert in matters of sanitary engineering, with special reference to questions and problems of public health, including industrial hygiene, clearly emphasize the sanitary dangers of subway employment. In fact, Doctor Soper stated in his address that he had advised the rapid transit board to this effect, pointing out that the metal particles in the air of the subway might produce injurious effects upon the health of the employees, and that this entire subject should be thoroughly investigated.^(a)

The investigations of Doctor Soper in behalf of the New York rapid transit commission were continued, and the following is from a brief printed summary of the results, bearing, in part, upon the health-injurious consequences of subway employment:

The investigation conducted for the New York rapid transit commission by Doctor Soper, to determine the sanitary conditions, particularly as regards the effect of the air upon the health of employees, has materialized in two reports, in the first of which the author states that although the subway air is disagreeable, it is not harmful except for the presence of iron dust. In the second of the two reports, dealing with the effect of iron dust upon the employees, it is stated that a sufficient number of persons were subjected to physical examination to determine the condition of the average employee. A careful search was made for evidences of diseases of the lungs, such as are common among people engaged in occupations where dust is present. An examination of the air showed the presence of a large amount of iron dust, and of various kinds of fragments due to the wear and tear of the subway and the abrasion of the clothing of the passengers. From the samples taken it was estimated that in every month 25 tons of iron and steel are ground off the rails, brake shoes, and wheels, on the 21 miles of the subway. Much of this material is in such large pieces that it falls immediately to the track, and adheres to the surface of the ballast or ties.

^a New York Medical Record, April 21, 1906, p. 614.

Among the conclusions reached by Doctor Soper are the following: The air of the subway as determined by analysis and careful studies of the health of the men is not injurious, the most objectionable feature being the dust, made up chiefly of angular particles of iron. The odor and heat of the subway, although they are disagreeable, are not actually injurious to health, the most objectionable atmospheric conditions, as far as health is concerned, being the strong drafts and changes of temperature which occur at the stations.

Careful physical examination showed that an excessive amount of dry pleurisy without pain or other physical discomfort existed among the men, the proportion being 53 per cent among the employees, as compared with $14\frac{1}{2}$ per cent among persons not engaged in subway work. Congestion and inflammation of the upper air passages were prevalent.^(a)

Doctor Soper presents his final conclusions on the air of the New York subway in the *Technology Quarterly* for March, 1907, including a qualified technical analysis of the problems of temperature and humidity, the chemical and bacteriological condition of the air, the unpleasant odors more or less prevalent at all times and in all places in the subway, and finally, with reference to dust, the conclusions are summed up, as follows:

The dust was examined microscopically, chemically, and bacteriologically, by a special method which was devised for determining the gross weight of dust in a measured volume of the air, and by an instrument for estimating the total number of floating particles present.

It was possible, by means of a common horseshoe magnet held beneath a piece of paper sprinkled with the dust, and slowly moved from side to side, to distinguish particles of iron and steel. These metal particles could be made to rise on edge and reverse their position by changing the pole of the magnet presented to them.

In appearance the dust was always black and very finely powdered. It was easily distinguishable by the eye from dusts collected in the streets, and in theaters, churches, office buildings, and mercantile and manufacturing establishments.

The subway dust had a peculiarly adhesive character, which caused it to attach itself securely to all surfaces, even when these were vertically placed and glazed. All parts of the subway which had not been recently cleaned and painted, or were not of a dark color, were sprinkled with this black dust when the investigation began.

When examined microscopically, the dust was found to be composed of particles of many substances, conspicuous among which were fine, flat plates of iron. In fact, these iron particles could often be seen with the naked eye, glistening upon the hats and garments of persons who had been riding in the subway.

Particles 2 millimeters [0.08 inch] long were, on one occasion, taken from a magnet which had been carried in the hand on a ride of twenty minutes in the cars. By comparison, it was found that magnets hung up in the subway collected more particles of iron than

^a *Scientific American*, August 31, 1907, p. 146.

magnets of the same size and strength hung up in an iron foundry or a dry grinding and polishing establishment.

Particles of subway dust, not iron, comprised bits of silica, cement, stone, fibers of wood, wool and cotton, molds, and indistinguishable fragments of refuse of many kinds.

The separate chemical analyses of eleven samples of accumulated dust from the subway showed the following average percentage composition: Total iron, 61.30, including 59.89 metallic iron; silica, etc., 15.58; oil, 1.18; organic matter, 21.94.

A large part of the metallic iron came from the wear of the brake shoes upon the steel rims of the wheels of the cars. The wear upon the brake shoes was very severe. By weighing them when they were new and after they were worn out, and determining the number used, it was calculated by the operating company that one ton of brake shoes was ground up every month for each mile of subway.

There was also some loss to the rails and rims of the wheels and to the contact shoes which ran upon the third rail. Probably 25 tons per month would be a low estimate of the weight of iron and steel ground up in the whole subway every month.

The average weight of dust found in the subway * * * was 61.6 milligrams per thousand cubic feet of air, or 2.25 milligrams per cubic meter; in the streets, 52.1 milligrams per thousand cubic feet, or 1.83 milligrams per cubic meter; difference, 9.5 milligrams. The maximum * * * was 204 milligrams.

The weight of dust which the average passenger inhaled in one-half hour in the subway was very slight. Assuming that 360 cubic centimeters, or 22 cubic inches, of air were taken in at each breath, and that the passenger breathed 18 times per minute, the total quantity of air which passed into the lungs in half an hour was about 6.88 cubic feet, or 0.19 cubic meter. Using the average of all results, or 61.6 milligrams per 1,000 cubic feet, as the weight of dust suspended in the atmosphere, it appears that the average passenger took into his nose or mouth 0.42 milligram of dust in a ride of half an hour.

The stations where the greatest weights of dust were found were express stations; there the amount of metallic dust formed by the braking of the trains was much greater than at the local stations and the travel from the streets greatest.^(a)

Quotations have been made at length from the investigations of Doctor Soper, because they constitute the only qualified inquiry which has been made into the subject. Subways are being constructed in several cities, and the number of persons employed in subway transportation is constantly increasing. The employment, however, is too new to afford an opportunity for a statistical analysis of the mortality which has occurred, but the preceding general considerations bring out clearly and forcibly the danger of subway dust and its relation to the occurrence of pulmonary consumption as well as to the occurrence of diseases of the lungs and air passages generally. The occupation

^a Technology Quarterly, March, 1907, pp. 108-116. Reprinted in annual report of the Smithsonian Institution for 1907, and as a separate publication, No. 1852, Washington, D. C., 1908.

demands rigid supervision by the sanitary authorities on the one hand, and by the transportation companies on the other. It would be advisable to have the men examined periodically by medical men, and nothing which sanitary science can suggest should be left undone to reduce the dust danger to a minimum. While statistical data are not available at this time, the conditions inimical to life and health in connection with subway employment may be considered as already established, and although the dust in subways is injurious to the health chiefly of employees continuously at work therein, it also has its serious significance to the millions of passengers compelled to make use of the subways for transportation purposes.

SUMMARY OF CONCLUSIONS REGARDING OCCUPATIONS WITH EXPOSURE TO MUNICIPAL DUST.

Four occupations exposing to municipal dust have been considered in detail. While the data for the different occupations considered are not always identical, the statistics available indicate with approximate accuracy the health-injurious effect of the employments. Only one group of such occupations—draymen, hackmen, and teamsters—is included in the vital statistics of the United States census of 1900. The total number of males in that group 15 years of age and over in the last census year was 532,637. Of this number only 10,777, or 2 per cent, had attained to age 65 and over, against a normal expected proportion of 4.7 per cent. The details of the age distribution are given in the following table by divisional periods of life, together with the corresponding percentage distribution of all occupied males:

NUMBER AND PER CENT OF MALES IN EACH AGE GROUP IN OCCUPATIONS WITH EXPOSURE TO MUNICIPAL DUST, COMPARED WITH NUMBER AND PER CENT IN ALL OCCUPATIONS IN THE UNITED STATES, 1900.

[From report on Occupations, Twelfth Census of the United States, 1900.]

Age.	Males in occupations exposed to municipal dust.		All occupied males.	
	Number.	Per cent.	Number.	Per cent.
15 to 24 years.....	141,671	26.6	5,933,720	26.0
25 to 34 years.....	164,052	30.8	5,993,847	26.3
35 to 44 years.....	117,865	22.1	4,704,682	20.6
45 to 54 years.....	67,923	12.8	3,250,259	14.3
55 to 64 years.....	30,349	5.7	1,856,181	8.1
65 years and over.....	10,777	2.0	1,063,856	4.7
Total.....	532,637	100.0	22,802,545	100.0

According to this analysis the proportion of males 15 to 44 years was rather large in the group of occupations exposed to municipal dust, or 79.5 per cent, against a normal expected percentage of only 72.9. At ages 45 to 54 the proportion was 12.8 per cent, against an expected percentage of 14.3 for occupied males generally, while at

ages 55 and over the per cent of draymen, hackmen, and teamsters was only 7.7, against an expected percentage of 12.8.

It is unfortunately not possible to present a combined summary of the census vital statistics of males employed in all of the occupations included in this group of employments exposing to municipal dust, since it is only for draymen, teamsters, and hackmen that the census data have been made public. In the registration area of the United States the census death rate from consumption for draymen, teamsters, and hackmen was 2.6 per 1,000, against 2.4 for all occupations, and the death rate from other respiratory diseases was below the average of 1.7, against 2.0 expected.

The occupation mortality statistics of Rhode Island are available only for drivers and teamsters in the group of employments exposing to municipal dust. The Rhode Island returns are for 531 deaths from all causes, of which 131 were from consumption and 77 from other respiratory diseases. The corresponding percentages were 24.7 per cent of deaths from consumption for persons employed as drivers and teamsters, against 17.8 per cent for occupied males generally in the State of Rhode Island. The percentage of deaths from other respiratory diseases was 14.6, as compared with 12.5 for all occupied males in Rhode Island.

The English vital statistics for this group of occupations are available for carmen and carriers, and for cabmen, coachmen, and men employed in omnibus service. When the returns for these occupations are combined, they show an excessive mortality at ages 25 and over from all causes, and at ages 35 and over from consumption. The death rates from other respiratory diseases are excessive at all ages 20 and over. The statistics in detail, by divisional periods of life, are set forth in tabular form as follows:

MORTALITY FROM ALL CAUSES, FROM CONSUMPTION, AND FROM OTHER RESPIRATORY DISEASES IN OCCUPATIONS EXPOSED TO MUNICIPAL DUST, COMPARED WITH THAT OF ALL OCCUPIED MALES IN ENGLAND AND WALES, 1900 TO 1902, BY AGE GROUPS.

[From Part II, Supplement to the Sixty-fifth Annual Report of the Registrar-General of Births, Deaths, and Marriages in England and Wales.]

Age at death.	Death rate per 1,000 due to all causes among—		Death rate per 1,000 due to consumption among—		Death rate per 1,000 due to other respiratory diseases among—	
	All occupied males.	Occupations with exposure to municipal dust.	All occupied males.	Occupations with exposure to municipal dust.	All occupied males.	Occupations with exposure to municipal dust.
15 to 19 years.....	2.44	2.44	0.54	0.48	0.24	0.22
20 to 24 years.....	4.41	3.98	1.55	1.12	.48	.49
25 to 34 years.....	6.01	6.56	2.03	1.97	.77	1.01
35 to 44 years.....	10.22	12.81	2.74	3.23	1.66	2.35
45 to 54 years.....	17.73	20.58	3.04	3.45	3.32	4.10
55 to 64 years.....	31.01	35.65	2.16	2.35	6.54	8.50
65 years and over..	88.39	101.76	1.11	1.22	17.77	23.69

The industrial insurance mortality statistics are available for street cleaners, drivers, and teamsters, and for cabmen, coachmen, and hackmen. These occupations returned in the aggregate 4,681 deaths from all causes, and of this number 1,195, or 25.5 per cent, were from consumption. The deaths from other respiratory diseases numbered 787, or 16.8 per cent. The expected percentage by the standard adopted for the registration area of the United States was 14.8 per cent for consumption and 11.7 per cent for other respiratory diseases. When the mortality from consumption, and respiratory diseases other than consumption, are combined, the proportionate number of deaths among men in occupations with exposure to municipal dust is found to be 42.3 per cent in this group of causes, against 26.5 per cent expected.

PROPORTIONATE MORTALITY FROM CONSUMPTION IN OCCUPATIONS EXPOSED TO MUNICIPAL DUST, 1897 TO 1906, COMPARED WITH THAT OF ALL MALES IN THE REGISTRATON AREA OF THE UNITED STATES, 1900 TO 1906, BY AGE GROUPS.

[Figures for occupations exposed to municipal dust from experience of an industrial insurance company; figures for males in the registration area computed from mortality statistics of the United States census.]

Age at death.	Deaths in occupations with exposure to municipal dust, 1897 to 1906, due to—		Per cent of deaths due to consumption among—	
	All causes.	Consump-tion.	Occupations with exposure to municipal dust.	Males in registration area, 1900 to 1906.
15 to 24 years.....	425	145	34.1	27.8
25 to 34 years.....	1,178	466	39.6	31.3
35 to 44 years.....	1,165	378	32.4	23.6
45 to 54 years.....	856	142	16.6	15.0
55 to 64 years.....	618	49	7.9	8.1
65 years and over.....	439	15	3.4	2.7
Total.....	4,681	a1,195	a 25.5	b 14.8

^a There were also 787 deaths from other diseases of the respiratory system, or 16.8 per cent of the deaths from all causes.
^b The per cent of deaths from other diseases of the respiratory system in the registration area was 11.7.

It is evident from the foregoing observations and statistical data relating to a number of representative employments with exposure to municipal dust that the health-injurious effects of such exposure are reflected in the comparatively small proportion of persons of advanced years, the comparatively high general death rate, and the comparatively high specific death rates from consumption and from other respiratory diseases.

OCCUPATIONS WITH EXPOSURE TO GENERAL ORGANIC DUST.

GRAIN HANDLING AND STORAGE.

Modern processes in handling and storing grain eliminate to a considerable extent the necessity for human labor, and the tendency is toward the further introduction of automatic appliances, chiefly for the purpose of mixing and conveyance. Modern grain elevators are enormous structures, in some cases with a capacity of more than a million bushels, but the actual number of laborers employed in them is comparatively small. The processes are simple, and are briefly described as follows:

The grain is dropped from the car into a pocket under the floor; in this pocket, or boot, is the lower end of the line of belts armed with steel buckets that scoop up the grain and carry it to the top story, emptying it there into receiving bins one hundred and fifty feet above the car. From these receiving and separating bins, or hoppers, it passes down to a series of hoppers on the floor below by simple gravitation. In these hoppers it is weighed, and passes down, by an ingenious revolving device, into whichever of the huge storage bins it is directed to. From these, when needed, it is simply spouted into boats or cars for shipment.^(a)

A modern grain elevator is, as a rule, built circular in shape, of hollow terra-cotta tile, the interior being practically inaccessible for general purposes. No labor attendance is required except, perhaps, for occasional inspection purposes. On account of the fire hazard and the liability to dust explosion, the earlier type of wooden structure is gradually passing away. Four types of modern elevators are recognized: (1) Those having rectangular bins built of steel plates; (2) those having cylindrical bins built of steel plates; (3) those having cylindrical bins of tiles strengthened with steel bands; and (4) those having cylindrical bins built of concrete. These are elevators for storage purposes, and there is really no necessity for anyone to enter the bins, which are in most cases practically inaccessible. When the grain is transferred in bulk from terminal elevators to barges or steamers a considerable quantity of dust is apt to be generated except where the process is substantially an automatic one. A large number of grain shovelers, however, are employed, especially in the cities on the Great Lakes, and that the condition of this class of labor is not a satisfactory one was brought out in the grain shovelers' strike at Buffalo a few years ago.

The liability to dust inhalation affects nearly every employment necessary in connection with grain handling or storage, and the em-

^a Cosmopolitan Magazine, March, 1899, p. 495.

ployment has, from the earliest times, attracted the attention of authorities on occupation diseases. Ramazzini, writing in 1670, held that:

All grain, and especially wheat, whether kept in pits under ground, as in Tuscany, or in barns, as in the countries upon the Po, have always a very small powder mixed with them; I mean not only that which they gather upon the barn floor in threshing, but another worse sort of dust, that grain is apt to throw from itself upon long keeping. For the seeds of corn being replenished with a volatile salt, insomuch that if they are not well dried in the sun before they are laid up, they heat mightily, and turn presently to a powder; it can not be but that some thin particles must fly off from the husk that surrounds them, over and above the powder and rotten dust proceeding from the consumption made by moths, worms, mites, etc., and their excrements. Now there being a necessity of sifting and meting corn and other grain, the men employed in that service are so plagued with this powder or dust, that when the work is done they curse their trade with a thousand imprecations. The throat, the lungs, and the eyes sustain no small damage by it, for it stuffs and dries up the throat; it lines the pulmonary vessels with a dusty matter that causes a dry and obstinate cough; and it makes the eyes red and watery. Hence it is that almost all who live by that trade, are short breathed, and cachetic, and seldom live to be old; nay they are very apt to be seized with an orthopnœa, and at last with a dropsy. Besides, this powder has such a sharpness in it, that it causes a violent itching, all over the body.^(a)

This opinion of a careful and scientific observer of actual conditions has been confirmed by subsequent inquiries, but there has been so decided a change in the methods of grain handling in large quantities that the dust nuisance has been materially reduced. Another factor favorably affecting the health conditions in this employment is that the habits of the men have undergone a material improvement for the better, and as brought out in the grain shovelers' strike at Buffalo, previously referred to, one of the main contentions on the part of the men was that they should not be paid by the inspectors at places selected by them near to saloons.

Halfort, a German authority on trade diseases, writing in 1845, observed that grain measurers and dusters were exposed to an extremely irritating dust injurious to the lungs, while the bent position on the part of the workmen during the sifting process was unquestionably a predisposing cause of lung diseases.

Hirt studied exposure to grain dust at considerable length, including threshing and other agricultural employments. He called attention to observed differences in the effects of different kinds of grain,

^a Treatise of the Diseases of Tradesmen, Ramazzini, English edition of 1705, pp. 170, 171.

but his conclusions were not final. His analysis of grain dust proved the presence of considerable quantities of mineral matter, chiefly silica or common earth, while the organic particles were minute portions of the grain proper and other vegetable matter. In his opinion the effect of the dust was extremely irritating, especially to those not accustomed to it, causing much cough and acute bronchial catarrh. While he considered rye and wheat dust most injurious, because of the peculiar microscopical structure of the grain particles, he refers to the much larger relative quantity of dust generated in the handling of oats, but apparently the observations were not conclusive. Of course, in the case of agricultural laborers the actual exposure is comparatively short and in this respect less serious than in the case of men employed in the handling and storage of grain at terminal elevators. Even in the case of these men, however, there is the advantage of seasonal employment, and since practically no skill is required, many of the men employed are only casual laborers. This accounts, in part, for the fact that the consequences of dust exposure, which would otherwise probably be serious, have not been observed to be such in actual practice.

An extended account of the atmosphere in granaries is included in the Annual Report of the Chief Inspector of Factories and Workshops of Great Britain for 1904. While this report describes conditions typical of English ports, the descriptive account is equally applicable to present-day conditions in this country:

The cargoes of grain arrive at irregular and uncertain periods, and it is only when they are being discharged that the whole of the machinery is at work, and an opportunity of complete inspection is afforded. I found that the grain after being elevated from the ship's hold falls down through a chute into the basement. In the course of its descent much of the dust gets separated from the grain, and there are two openings near the bottom of the chute through which the dust is drawn by an exhaust fan into a settling chamber. A second elevator takes the grain from the basement to the top floor, where it is carried by conveyer bands to the bins. No automatic weighers are used. A considerable amount of dust is said to be given off as the grain falls into the bins. Only three or four men including the foreman are usually employed, and the number on no occasion is said to exceed six. The foreman stated that he had been engaged in this work for 13 years and had never felt any ill effects from the dust. Two other men informed me they had been employed here for three and six years respectively, and that during this time their health had been very good. Only about one hour's trimming at a time is necessary for each bin, and the men are frequently not employed in this work for days together. Russian oats, it is said, give off the greatest amount of dust.^(a)

^a Annual Report of the Chief Inspector of Factories and Workshops for the Year 1904, p. 13.

A similar inquiry was made into the health of persons employed at other grain elevators, and although some of the work people had been at work there for many years, they made no serious complaint of having suffered as the result of exposure to grain dust. The report includes a descriptive account of a grain elevator at Leeds by the local inspector of the department, who remarks that—

The most perfectly equipped place I have seen is in Leeds, in a warehouse or grain-cleaning factory, belonging to, but not connected with, a large flour mill. It is situated on the side of the river and the grain is conveyed direct from the boats into the factory by means of an elevator. The grain is carried by the elevator to the weighing machine, then it passes through a cleaning machine, where the dust and all dirt, soil, bits of stick or hemp, etc., are extracted, the dust being drawn by fans into one receptacle and the other rubbish into another. It afterwards passes up to the silos in wooden pipes. Everything is covered in, so that from the time grain enters the mouth of the elevator to the time it reaches the silo it is never exposed. The only dust that escapes is just round the weighing and cleaning machines, as some of these joints and connections can not be perfectly dust tight, but as the processes are automatic it is not necessary for any man to be constantly present to attend to the work. From the silos, which are completely covered in, the grain runs down into sacks at the bottom, when required to be taken to the mill. Satisfactory as this may be inside, there are those men in the boats, engaged in shoveling the grain towards the mouth of the elevator, who are in the midst of clouds of dust all the time.^(a)

Here, again, the general conclusions were to the effect that the employment had not been observed to be decidedly injurious to health, and these conclusions were confirmed by the local inspector for Newcastle-upon-Tyne, who, after stating that most of the work at granaries was of an intermittent character, so that the men were only for brief periods exposed to the dust, further stated that he had not observed any evidence of injury to health, but ascertained that the opinion of the men was to the effect that the dust from American grain was considered more objectionable than that from Hungarian and Egyptian grains, the American grain being said to contain sharp particles of husk which, it was alleged, had a very irritating effect on the respiratory passages.

The subject is further considered in the Annual Report of the Chief Inspector of Factories and Workshops for the year 1906, who, referring to a special report by one of the local inspectors for East London, states that it has been found that an ordinary handkerchief tied over the nostrils and mouth is a much better protection than respirators, for the latter become speedily choked with dust and

^a Annual Report of the Chief Inspector of Factories and Workshops for the Year 1904, p. 111.

breathing becomes most difficult. This inspector stated further that—

At two large dockside granaries bucket elevators were chiefly used at one and band conveyors at the other, the dust generated being worse in the latter case, escaping chiefly where the corn leaves the shoots and falls on to the band. In both these cases respirators were provided for the men, who absolutely refused to use them. In the process of turning over the corn to prevent heating, and shoveling it into the shoots from the sides of the bins, the men work in a cloud of dust. If the bins were made funnel-shaped this latter process might in many cases be dispensed with, but more space would be required. The composition and amount of dust in corn of course varies considerably; some appears to be all husks and some all dried mud. I saw the dust collected from an average quality of foreign barley that had been screened with a machine fitted with a fan flued to a dust chamber. This measured one sack of dust per hundred sacks of corn, and in addition to this there was the dust that escaped and other heavy foreign matter sieved from the corn.^(a)

While the evidence as to the quantity of dust generated in connection with the various processes was entirely conclusive, it was, to the contrary, inconclusive as to the health-injurious effects upon the men employed. No doubt the deliberate policy on the part of the local factory inspectors to reduce the dust nuisance in English granaries to a minimum has been decidedly beneficial, and conditions in that respect are not only much better now than they were in former years, but they are also possibly better and more satisfactory than in the large terminal elevators and cargo-loading plants in the United States.

The only available vital statistics of grain handlers and grain elevator employees in the United States are the recorded industrial mortality data, including, however, only 24 deaths from all causes, of which 5, or 20.8 per cent, were from consumption. If the deaths from consumption and from other respiratory diseases are combined, 25 per cent of the mortality of grain handlers and grain elevator men was from diseases of the lungs and air passages. The number of deaths of men in this occupation included in this analysis is not sufficient for a final conclusion, but it is suggestive of health-injurious circumstances destructive to life and health. The facts in detail are brought out in a tabular presentation of the proportionate mortality from this disease by divisional periods of life.

^aAnnual Report of the Chief Inspector of Factories and Workshops for the year 1906, p. 16.

PROPORTIONATE MORTALITY FROM CONSUMPTION AMONG GRAIN HANDLERS AND ELEVATOR MEN, 1897 TO 1906, COMPARED WITH THAT OF ALL MALES IN THE REGISTRATION AREA OF THE UNITED STATES, 1900 TO 1906, BY AGE GROUPS.

[Figures for grain handlers and elevator men from experience of an industrial insurance company ; figures for males in registration area computed from mortality statistics of the United States census.]

Age at death.	Deaths of grain handlers and elevator men, 1897 to 1906, due to—		Per cent of deaths due to consumption among—	
	All causes.	Consumption.	Grain handlers and elevator men.	Males in registration area, 1900 to 1906.
15 to 24 years.....	1	.....	.....	27.8
25 to 34 years.....	7	1	14.3	31.3
35 to 44 years.....	5	2	40.0	23.6
45 to 54 years.....	7	1	14.3	15.0
55 to 64 years.....	2	.....	.....	8.1
65 years and over.....	2	1	50.0	2.7
Total.....	24	5	20.8	14.8

For the time being the conclusions regarding the health-injurious effects of exposure to grain dust rest almost entirely upon recorded, and fairly competent medical observations. These observations are, in part, confirmed by the available recorded industrial mortality experience. It is much to be desired, however, that the matter should be made the subject of a thorough and qualified scientific inquiry in the Lake and Atlantic ports, where the largest number of grain elevator men and grain handlers are employed.

FLOUR MILLING.

The flour-milling industry in the United States, including grist-mill products, employed in 1905 nearly 40,000 wage-earners, of whom 450 were women. Since the manufacturing census is limited to establishments of a certain size and excludes custom gristmills, the product of which is consumed in the immediate vicinity, and which is, therefore, considered a neighborhood industry, the actual number of wage-earners employed in connection with flour and grist mills is probably not far from 50,000. The census of occupations, 1900, enumerated 40,576 millers, of whom 34,567 were native born and 6,009 were foreign born. Although the number of mills throughout the country is very large, a comparatively small number of mills grind a comparatively large percentage of the wheat ground in the United States. While wheat flour is the chief product, considerable quantities of rye, buckwheat, barley, corn, and other grains are made into flour; this, however, proportionately is insignificant, compared with the enormous extent of wheat-flour milling in the United States. The distinction between custom mills and merchant mills is a very

important one, since the exposure to flour dust is much greater in the former establishments than in the latter, chiefly operating by the patent-roller process. Out of 25,258 flour mills enumerated by the census of manufactures of 1900, 2,620 were merchant mills, 14,905 were custom or exchange mills, and 7,733 combined both methods.

The essential differences in methods of flour milling are briefly described in the census of manufactures, 1900, from which the following is quoted:

There are three distinct types of grinding machines used for reducing cereal grains to a powder. First, the mortar-and-pestle type, in which grinding and rubbing are the chief forces of impact employed. Second, some form of machine presenting two roughened surfaces, one or both of which may be in motion (usually only one), between which the grain is crushed or cut. These roughened surfaces may be either of stone or hardened steel. Third, the roller system of milling, illustrating the mashing process, in which the grains are disintegrated and reduced to successive stages of subdivision by passing through rolls, smooth or corrugated, in which, from one series to another, there is an increasing approximation of the surfaces.

These represent ascending types in the art of milling. The first represents the primitive and original method of disintegrating the grains; the second the intermediate step, which persisted until within perhaps a quarter of a century; and the third and last and final step in the evolution of the art. The third method is now almost universally employed, especially in mills of any magnitude.^(a)

Of these methods the last named has become the most important, although a large number of custom flour and grist mills continue to operate. These, as a rule, run only for a portion of the year and employment therein is more or less intermittent, and often the duties are performed in connection with farm labor or similar work. The patent-roller process has eliminated to a large extent the dust nuisance common in the old-style flour mill, and while the process is rather involved and difficult of exact description, the following observations from an extended account of the industry will prove useful for the purpose of emphasizing the degree of dust exposure in the different employments:

The roller mill consists of a frame carrying two pairs of steel rolls, one roll of each pair being revolved in a direction opposite to the other. The rolls run at different speeds by means of differential belts. The prepared grain is fed between the rolls, striking the slow rolls first, and is then cut by the fast roll, so as to shell out the contents. The broken kernel is then elevated to a sieve machine called a "scalper," which consists of a flatwise sieve, which allows the granular material, which is called "middlings," to pass through the meshes, while the coarser part of the kernel passes over the sieve to

^a Report on Manufactures, Part III, Twelfth Census of the United States, 1900, p. 370.

the second set of rolls. This process is repeated five times (the grinding and sifting operations).

The next process is the dividing of the middlings into various grades according to the size of the granules. The middlings from these five siftings are delivered to a grader, which may be either a reel or a sifter machine. These grading reels are covered with silk bolting cloth of various degrees of fineness, the finest section being near the head of the reel, and graduated toward the tail of the reel. It is a mistake to suppose that these grades differ in value; they relate entirely to size. Each grade of middlings is now put through a machine termed a middlings purifier. The introduction of this machine has revolutionized the practice of milling. The stock is fed in at one end of the sieve, and is advanced by the end motion of the sieve, which is covered with silk bolting cloth. A current of air is drawn up through the sieve by a fan located in the upper part of the machine; this carries off any fine dust into the dust collector, where it settles. The dust collector consists of some form of cloth tubes. The air forces the dust to the walls of the tubes and passes through the mesh, leaving the dust on the inside.

The particles of bran that are with the middlings whose specific gravity is less than the interior of the kernel are kept from going through the meshes by the upward current. The bran is held in suspension until the end of the sieve is reached, when the air current is cut off, allowing it to fall into a separate conveyor. The purified stock which passed through the sieve is delivered by means of conveyors to a second purifier, whose action is the same; brushes moving at right angles to the motion of the sieve serve to keep the meshes of the cloth open. Each grade of middlings goes through the same process of purification. After the middlings are thoroughly purified, they go to the smooth rolls, where they are partially crushed, but not powdered. The life of the flour is killed if it is pulverized. From there it goes to the bolter, which is made in many forms, but for purposes of illustration we will consider a round reel or "flour dresser," as it is called. The reel is covered with fine silk bolting cloth, which may cost as much as \$4 a yard. What flour is fine enough to go through the meshes of this reel is sent to the flour bins, and is ready for packing. What is too coarse to go through goes to the rolls and is recrushed and rebolted, and this process is repeated until all the middlings are crushed fine enough to go through the meshes of the cloth. The bolting cloth is kept free from clogging by a revolving brush, and the stock is thrown against the inner side of the cloth by beaters revolving around a horizontal shaft.

The flour is now ready for packing in barrels of 196 pounds and bags which range from 3 to 280 pounds. The barrels are placed on a machine located beneath the bin, and adapted to supply a large volume of flour, which will approximately fill the barrel; the supply is automatically cut off when the proper weight is reached.^(a)

The foregoing processes require the employment of a widely diversified group of wage-earners, classified by the bureau of labor statistics of Minnesota into head millers, second millers, grinders, bolters, stone dressers, flour packers, bran packers, nailers, flour counters,

^a Scientific American, February 27, 1904, p. 177.

oilers, sweepers, dust-house cleaners, elevator foremen, millwrights, machinists, engineers, electricians, storehouse men, warehousemen, and common laborers. The degree of dust exposure differs naturally and considerably with the various employments, being at its worst in the case of flour packers, bran packers, nailers, flour counters, sweepers, dust-house cleaners, warehousemen, and storehouse men. Grinders and bolters, on account of the fact that most of the modern machinery is completely inclosed, are only slightly exposed to flour dust, but the employment most injurious to health is that of the buhrstone dressers, who are exposed not only to the inhalation of flour dust—since the stones are dressed in the mill—but also to a considerable and continuous inhalation of mineral and metallic dust.

In most of the modern mills the dust house has been eliminated and an automatic dust collector is used instead, the dust from each machine being gathered in a pipe and carried to some one of these collectors, whence it is automatically conveyed to a central collector, from which it is blown into a tube and forced out of the mill into the river. This has made the employment of dust-house cleaner almost obsolete.

The earliest recorded observations regarding the health of flour millers are by Ramazzini, who, writing in 1670, held that:

In the first place those who bolt the flour and cleanse it from the bran, and are always shaking and turning the sacks and bags, can not possibly so cover their face as to avoid the inspiration of the flying particles of the meal, together with the air; and these being fermented with the salivary juice, stuff up not only the throat, but the stomach and the lungs with a tough paste; by which means they become liable to coughs, shortness of breath, hoarseness, and at last to asthmas; the wind pipe and the passages in the lungs being lined with a crust that interrupts the intercourse of the air.^(a)

Ramazzini also considered the most effectual means of preserving the health of flour millers, chiefly, of course, with reference to protection against the inhalation of flour dust, and he gives his indorsement to the custom of tying a linen cloth over part of the face, which then prevailed, but even this, he held, was not entirely sufficient to prevent the inhalation of flour dust.

Thackrah, writing in 1832, took an equally serious view of the employment, as one more or less detrimental to health and life, pointing out in his treatise on the effects of trades and professions on health and longevity that—

Corn millers, breathing an atmosphere loaded with the particles of flour, suffer considerably. The mills, indeed, are necessarily exposed to the air,—the number of men is comparatively small, and the labor is good. Yet millers are generally pale and sickly; most

^a Treatise of the Diseases of Tradesmen, Ramazzini, English edition of 1705, p. 143.

have the appetite defective, or labor under indigestion; many are annoyed with morning cough and expectoration; and some are asthmatic at an early age. The average circumference of the chest in ten men, whom we measured, was 36 and 2-5ths inches; and the quantity of air thrown out by a full expiration was somewhat less than 202 cubic inches. Though we found several who had borne the employ from boyhood to the age of 50 or 60, the individuals were by no means robust; and we could not find an instance of an aged and healthy miller. The preceding statements do not apply to the men who drive the corn and flour carts, nor to the porters who unload the grain. These persons are little exposed to dust, labor chiefly in the open air, and are generally selected for their muscular power. They are, however, like other men who carry great weights, subject to hernia.^(a)

Thackrah concludes his remarks with some additional observations as to the habits of the workmen and the surrounding circumstances of their employment, and, after observing that night work did not seem to affect sensibly the health of the workmen, remarked that—

The evils of the employ might be much reduced by the men's taking exercise in the open air. It is apparent that those who work from 12 to 12 have time to enjoy a pure atmosphere for several hours a day. In this, as well as other employments, we remark with regret the men's inattention to health, their indifference to the prevention of disease. They think nothing of injurious agents till their health is destroyed, and the time for prevention is passed. The dust might, I conceive, be removed, or greatly diminished, by a current of air under the floor. The ill effects on hearing, of this and other noisy occupations, might be lessened or prevented by putting cotton in the ear passages.^(a)

The observations of Ramazzini and Thackrah were confirmed by the more scientific investigations of Hirt, who quoted statistical data to the effect that out of 100 cases of sickness among flour millers there were about 42 due to acute or chronic respiratory diseases, and of these phthisis caused 10.9 per cent, and emphysema 1.5 per cent, bronchial catarrh 9.3 per cent, and pneumonia 20.3 per cent. He attributes the very considerable proportion of sickness from pneumonia to the exposure of flour millers to changes of temperature, cold drafts, etc., in conjunction, of course, with exposure to flour dust. While the number of cases of sickness from respiratory diseases was relatively high among flour millers, the actual mortality, as observed by Hirt, was not materially in excess.

In a lecture before the Society of Arts, in 1876, it was observed, with regard to the health-injurious circumstances of flour milling, that—

Flour dust is another of the obstructive as well as irritative dusts, and men who work in flour mills afford, I think, the most striking

^a Effects of Arts, Trades, and Professions on Health and Longevity, by C. Turner Thackrah, 1832, pp. 63, 64.

illustrations of obstruction of breathing from the inhalation of minute particles of solid matter. The particles of flour produce comparatively but little irritation, but they are carried readily into the bronchial tracts through the minute ramifications of the bronchial surface, and render the breathing irregular through parts of the lung. Thus an irregular pressure of the inspired air is brought about, an undue pressure is exercised upon some portion of the lung structure, there is rupture or break of the minute vesicular structure, and therewith the development of that disease of the lung which is technically called emphysema. The symptoms attendant on this condition are those of suffocative breathing and spasmodic cough. They constitute the disease commonly called "miller's asthma."^(a)

The material changes in methods of manufacture make some of the earlier observations by writers on occupation diseases inapplicable to the occupation at the present time. Arlidge, writing with special reference to employment in modern flour mills, makes the statement that—

Flour mills have had a bad reputation so far as the health of millers is concerned; and the most dismal accounts of their attendant evils are to be read in old and in foreign writers on industrial diseases. It would serve no useful purpose to repeat those accounts, especially as our endeavor is primarily to represent the present hygiene of trades in our land, and as the milling business has, within comparatively few years, been transformed by the introduction of steel rollers in the place of the old millstones, and of marvelously contrived automatic machines, scarcely requiring the interposition of human hands from the beginning to the termination of the whole process of making flour. By these machines the separation of the bran, the "germs," and the semolina is effected, and necessary siftings are carried on in inclosed box-like constructions, whereby the escape of dust into the surrounding air is obviated. Nevertheless, as the miller requires from time to time to withdraw samples for testing, and to remove special products, one section or other has to be opened, with the emission of a slight quantity of the pulverized corn. Hence, although a modern corn mill contrasts strongly with one of olden time, it does not entirely cease to be a dust producer, and the flour makes itself visible on the clothes of the millers, as well as on surrounding objects. After the lapse of years it also produces shortness of breath, with cough and expectoration. Happily the grains of flour are readily miscible with fluid, and therefore are, to a very great extent, arrested in their passage into the lungs themselves by the fluids of the mouth and nasal openings with which they get mixed, in the form of semi-fluid pasty matter, and thereupon excite efforts, and usually successful ones, to remove them. In the same manner, should they reach the bronchial tubes, their miscibility with the secretions prepares the way for their expectoration.

However, we can well understand that exposure to flour dust for lengthened periods will end in some accumulations in the form of tenacious plugs, provocative of severe paroxysmal efforts to dislodge

^a Lecture on "Unhealthy trades," by Dr. B. W. Richardson, Scientific American Supplement, March 4, 1876, p. 155.

them by coughing; and, such efforts failing, remain to block tubes, with the result of causing, on the one hand, collapse of a small area or atelectasis; and, on the other, of emphysematous dilatation of an adjoining area, by reason of increased work and pressure upon its air cells.

There is undoubtedly but very slight irritation induced by grains of flour; nevertheless these can not fail, as foreign material, to exercise some excitation, sufficient, possibly, to set up after a while subinflammatory action. In old mills the men had to contend not only with grains of flour but also with the far more irritating particles of bran and of hair or bristles attaching to the corn, thrown off in the sifting operations; and by the action of which the lung parenchyma and air tubes were more seriously affected. Necessarily the proportion of these hard epidermic particles differed according as oats, barley, rye, or wheat was ground. It would appear that the worst asthmatic attacks are due to the dust of oats. Where men have been exposed to the inhalation of the coarser fragments derived from the epidermic appendages of corn the sputum has borne witness to their presence.^(a)

With reference to men employed in buhrstone cutting, Arlidge was of the opinion that—

The siliceous dust from the wear of the millstones was another injurious element that formerly intermingled with the flour, but has ceased to exist by reason of the adoption of steel rollers for grinding corn, and it seems unlikely that it could ever be one of importance.^(a)

Arlidge also quotes from the factory inspector's report for 1884 evidence to the effect that "it is quite exceptional to see a person who has worked any time in a flour mill who is not more or less affected as to the respiratory organs; and, contrary to the rule in most trades, the majority readily admit and deplore the fact." Arlidge, however, believed that this statement, in the light of his own investigations, including the personal inspection of mills erected and fitted under the most approved modern system, did not apply at the present time, in view of the great improvements made in all the details of the occupation.

The general conclusions of Arlidge are finally summed up, as follows:

Remembering that a modern mill is always four or five stories high, and each floor well-nigh filled with machinery, it is evidently a place of danger, and too frequently of accidents in connection with the shafts, belting, and wheels, though to a less extent than formerly. Moreover, flour mills are hazardous owing to their liability to fire and explosions; originating in the extremely fine dust diffused through the atmosphere, which, if accumulated above a certain measure, explodes on contact with flame; just as happens with fine coal dust in mines. Many explosions have occurred in this country, wrecking the mills and destroying life. To obviate this disaster, care is usually taken to inclose the flames of gaslights as far as practicable; whilst in other establishments electricity is introduced as the illumi-

^a Diseases of Occupations, by J. T. Arlidge, 1892, pp. 383, 384.

nating agent. But here, as happens with so many evils, prevention by thorough ventilation is the best cure.^(a)

Flour milling was briefly considered by Dr. Jacques Bertillon in his address on "Morbidity and mortality," including references to the observed mortality rate in various European countries, in part as follows:

Millers in England have a rather low mortality up to the age of 45 years, and a rather high one afterwards; the same occurs in Switzerland, the increase there taking place about 40. Phthisis is rare among them, as amongst other country folk, up to 30, average from 30 to 40, then fairly frequent. The Italian tables attribute to the millers, etc., a low morbidity up to 45, and a high one from 45 to 50.^(b)

As evidence of a further improvement in the conditions affecting the health of men employed in modern flour mills, reference may be made to the Report of the Chief Inspector of Factories and Workshops of Great Britain for 1900, in which the district inspector for the northwestern division states:

At eleven [flour mills] visited, four of which are very large mills, the general conditions were excellent, having regard to the nature of the processes and the number of hands (very few) engaged therein; and taking the larger works as representative of the various processes of milling flour, it was noted that there was practically no dust in those departments where it is most likely to abound, viz., in the preparing and cleaning of corn, previous to its grinding. This is directly attributable to the conditions under which the process is carried on. A strong blast of air is drawn by centrifugal fans into either a "cleaner," a "separator," or a "brusher," or similar machine (English and American made), and there meets with and cleanses the grain from foreign matter and dust, and carries these with it along a suitable duct to a collector. Thus the one agent not only separates the dust, but, by its mode of application, also carries away the dust it creates and prevents it being given off into the works. This is a type on which I venture to think dust preventing systems can well be modeled with certainty of successful result. In such a system the fan power required is considerable; with the flour miller it is a necessary item. In other dusty processes it may unfortunately be an addition to working expenses without a corresponding monetary return.^(c)

The foregoing observations and conclusions were fully confirmed by the inquiries made by the departmental committee appointed to inquire into and report on certain miscellaneous dangerous trades, which considered flour milling at considerable length. It pointed out that the occupation in former years had been so injurious that

^a Diseases of Occupations, by J. T. Arlidge, 1892, p. 386.

^b Journal of the Royal Statistical Society, 1892, p. 579.

^c Annual Report of the Chief Inspector of Factories and Workshops for the year 1900, p. 302.

even twenty years previous friendly societies would not accept operative millers as members, but that no objection to such membership was now heard of. The suggestions made by the committee as to further improvements were chiefly with regard to the wheat-cleaning department, and the committee included a recommendation that a fan should be attached to all grinding machinery, whether stones or rollers, and that the exhaust from all friction machines should be into the open air. It was further recommended that all dust should be blown into sacks instead of dust chambers, required to be cleaned out periodically, and that the cleaning out of these chambers when in use should be done only when the machinery was brought to a standstill. Among the observations of the committee the following is of particular interest, and is quoted in full:

In modern mills, the wheat cleaning machinery and the rollers where the milling is performed are both covered over, and the former machinery is almost universally provided with fans and dust chambers. It is important that the pipes connected with the fan should be cleaned out periodically. Where there is no fan or where that which has been provided is not in proper working order there is great danger to the workers in the wheat-cleaning department. It has been represented to the committee that the dust is very heavy and gritty, and that men do not last long who have to work in it.

Of other dusty processes the most important is sack cleaning; here beating in some form is required, and dust is necessarily produced. The methods adopted for removing the dust vary very much according to local conditions; access to the open air is not always possible, nor is a fan in all instances capable of satisfactory application.

For sack filling, another operation where there is a liability to injury from dust, the committee have seen a useful mechanical contrivance called a sack jumper. The mouth of the sack is closely bound round the bottom of the feeder or hopper, and by means of a lever at some distance the sack can be jumped up and down, thus causing the flour to fill the bag in a compressed instead of in a loose form. The workman is enabled by this means to stand at a distance from the hopper where the filling takes place, and consequently to escape much of the dust which otherwise he would risk inhaling. (^a)

To the foregoing is added, in conclusion, the remarks of Dr. Thomas Oliver, published in his treatise on Dangerous Trades in 1902:

Flour milling as conducted in this country a few decades ago was, despite the fact that most of the mills were situated in the country, an unhealthy industry. Flour millers died from pulmonary consumption and chest diseases in a larger proportion than men engaged in other trades in the same district. The average life of a miller was said to be forty-three years. Hirt compiled tables of the comparative sickness of millers and bakers, and he showed that while

^a Final Report of the Departmental Committee on Dangerous Trades, 1899, p. 22.

of one hundred bakers seven died from pulmonary phthisis, out of the same number of millers the deaths were ten. Bakers and millers seemed to him to be about equally predisposed to emphysema of the lungs, but as regards pneumonia the mortality figure for bakers was 8.4 per cent as against 42 per cent for millers. These statistics are taken from a German source, and it is difficult to explain the very heavy mortality rate from pneumonia in millers compared with that of bakers.

Until within thirty years ago all the wheat and oats in this country were ground between revolving stones. During the grinding a considerable amount of fine dust was given off, the continual inhalation of which was held responsible for much of the ill-health of the operatives. So unhealthy was the occupation of milling believed to be twenty years ago, that friendly societies would not accept operative millers as members. Today no objection is raised. In addition to injury to health from breathing the dust-laden atmosphere, there was a risk from fire owing to the highly explosive character of the dust. While danger to life from explosions in flour mills still to some extent prevails, both it and the risk to health from inhalation of the dust have materially diminished. There is the widest divergence possible between the old and the new methods of milling. The introduction of the steam roller system of milling from Buda-Pesth, and the fact that nearly all the various processes are carried on inside closed machinery, have cleared the atmosphere of modern flour mills and converted what was admittedly a dangerous trade into one that compares very favorably with most occupations. Wherever the old method of milling is still carried on the atmosphere is found laden with a very fine dust, mostly flour. This with each inspiration is drawn into the bronchial tubes of the miller, and forms plugs with the mucus secreted by these passages. The plugs, owing to their tenacity, are dislodged with difficulty. It is not contended that the flour itself reaches the lungs; probably the whole, or at any rate the most of it, becomes entangled in the mucus of the smallest bronchial tubes, but in the dust there are other things than flour present, e. g., portions of the husks of harder grain than wheat, portions of hairs of oats, bristles of rye, and particles of mineral from the grinding stones, so that through one thing and another, and in consequence of the repeated bronchial irritation and the cough caused by respiring the dust-laden air, a strain is imposed upon the lungs that leads to overdistention of the air cells, or what is known as pulmonary emphysema. That portions of bristles, etc., are capable of being inhaled into the deeper recesses of the respiratory passages is shown by the presence of these bristles on microscopical examination of the expectoration that has been discharged after hard coughing.

In modern flour mills the dangers that operatives are exposed to are: (1) Those incidental to the machinery; (2) fire and explosions; and (3) inhalation of dust. It is with the latter that we are here most concerned. The cleaning of wheat is a dusty process, but it is usually carried on within inclosed machinery, and so long as this and all the covered-in spaces are provided with fans that are kept in good order, and the pipes leading away from these to the dust chambers are kept patent, the workmen do not seem to incur any great risk

to health. Attention, however, must be given to keeping the suction pipes clean and the fans in good order, otherwise, as cleaning is a very dirty process, the men would assuredly suffer in their chest. Once the wheat has been cleaned and brushed or washed, it is put through the rollers and is milled into flour. This consists of not one but many processes, all of which are conducted in inclosed chambers, the product at each particular stage being lifted and carried onward by self-regulating machinery and elevators from one part of the mill to another. Where the fittings of the machinery are good, no dust practically escapes. Hence it is that flour milling has ceased to be the harmful industry it formerly was. In filling the sacks with flour, and in cleaning returned sacks, there is often a considerable amount of dust given off, but mechanical contrivances are now in operation that greatly minimize the amount of dust, so that this particular operation too has become less dangerous than it once was.^a

The number of male flour millers 15 years of age and over in the United States, according to the census report on occupations, 1900, was 40,182, and of this number 3,050, or 7.6 per cent, were 65 years and over, which compares with 4.7 per cent for the entire occupied male population of the continental United States. At ages 55 to 64 the proportion was 12.1 per cent, at 45 to 54 it was 19.1 per cent, leaving 61.2 per cent at ages 15 to 44, inclusive. The higher proportion of millers at advanced ages would indicate that, on the whole, the conditions favorable to life and health in this occupation, as it is now carried on in the United States, are probably satisfactory. It must be kept in mind, of course, that these numbers apply to millers as a class, and do not distinguish between the two important divisions; that is, those employed at custom flour and grist mills, and those employed at the patent-roller process. It is also not quite clear from the census statistics whether the occupation classification was strictly limited to millers, as such, or whether it was not made to include a number of connected employments, but with a much less degree of exposure to flour dust than in the case of millers, properly to be classified as such. With increasing complexity in industrial activity, an exact occupation classification becomes more difficult.

The occupation was briefly considered in the vital statistics of the census of 1900. The number of millers reported in the registration States was 6,044, among whom there occurred 161 deaths, or at the rate of 26.6 per 1,000. By specified periods of life, the death rate at ages 15 to 24 was 5.8, at ages 25 to 44 it was 10.5, at ages 45 to 64 it was 15.6, and at ages 65 and over, 164.9. The mortality from all causes was higher among millers at all ages than among manufacturing and mechanical employments generally, but the mortality from consumption was below the average, or 1.99 per 1,000, compared with 2.6 for the manufacturing and mechanical industry class. The

^a Dangerous Trades, by Thomas Oliver, 1902, pp. 505-507.

mortality from pneumonia was 2.98 per 1,000, or very materially in excess of the general average of 1.4 per 1,000 for the manufacturing and mechanical industry class. Unfortunately, the census returns do not give the causes of death by divisional periods of life, and it is, therefore, impossible to state how far the excess in the mortality from pneumonia may possibly have been the result of an age distribution favorable to a high general death rate from this particular disease.

The Rhode Island vital statistics of millers for the period of 1852 to 1906 include 54 deaths from all causes, of which 10, or 18.5 per cent, were from consumption. During the ten-year period ending with 1906 there occurred 14 deaths of millers, and of this number only 2 deaths, or 14.3 per cent, were from consumption, while 2 other deaths were from bronchitis, a total of 28.6 per cent of the mortality having been from diseases of the lungs and air passages.

The most recent English vital statistics of millers are for the three years ending with 1902, referred to in the Supplement to the Sixty-fifth Annual Report of the Registrar-General, in part as follows:

At ages 15 to 20 years millers experienced a mortality which is less than half that of occupied and retired males; with advancing years, however, this advantage gradually disappears, until after age 35 the rates differ little from the standard. In the main working time of life the comparative mortality figure is 890, or 11 per cent below the average. Millers suffer a slight excess of mortality from cancer as well as from respiratory diseases, from Bright's disease and from suicide; but under every other heading, except gout, their mortality is less than the standard, the difference being especially marked under the headings alcoholism and liver disease, phthisis, and diseases of the nervous system. (^a)

The foregoing observations in a measure confirm the corresponding American vital statistics, except as to the comparatively low degree of consumption frequency and the higher mortality from respiratory diseases. It is to be kept in mind, of course, in all inquiries of this kind that the medical classification of deaths is far from perfect, and there is no doubt that deaths are frequently recorded as having been due to respiratory diseases which were, in fact, the result of tubercular lesions, or at least were seriously complicated by such lesions. A comparatively high mortality from respiratory diseases among men employed continuously in a dust-laden atmosphere may, therefore, be considered as of equal significance as a high mortality from tubercular diseases. In the table which follows a comparison is made of the English mortality of millers from all causes with that of occupied males generally:

^a Part II, Supplement to the Sixty-fifth Annual Report of the Registrar-General of Births, Deaths, and Marriages in England and Wales, p. lxi.

MORTALITY FROM ALL CAUSES AMONG MILLERS, COMPARED WITH THAT OF ALL OCCUPIED MALES IN ENGLAND AND WALES, 1900 TO 1902, BY AGE GROUPS.

[From Part II, Supplement to the Sixty-fifth Annual Report of the Registrar-General of Births, Deaths, and Marriages in England and Wales.]

Age at death.	Death rate per 1,000 for all occupied males.	Death rate for millers.		
		Rate per 1,000.	Greater (+) or less (-) than rate for all occupied males.	Ratio to rate for all occupied males.
15 to 19 years.....	2.44	1.13	-1.31	46
20 to 24 years.....	4.41	2.94	-1.47	67
25 to 34 years.....	6.01	3.61	-2.40	60
35 to 44 years.....	10.22	9.05	-1.22	88
45 to 54 years.....	17.73	17.25	- .48	97
55 to 64 years.....	31.01	32.23	+1.22	104
65 years and over.....	88.39	98.23	+9.84	111

The mortality of English millers up to and including 54 years of age is shown by the preceding table to have been below the average for all occupied males during the period under consideration. When, however, the comparison is limited to the mortality from consumption and from other respiratory diseases, it is brought out that there is an excess in the mortality from the former disease at ages 65 and over, and an excess in the mortality from the latter at ages 35 and over. The facts, as far as they are obtainable from the published reports, are set forth in tabular form below, which shows the mortality by divisional periods of life from consumption and from respiratory diseases other than consumption among millers and among occupied males generally, first, from consumption, and second, from other respiratory diseases:

MORTALITY FROM CONSUMPTION AND FROM OTHER DISEASES OF THE RESPIRATORY SYSTEM AMONG MILLERS, COMPARED WITH THAT OF ALL OCCUPIED MALES IN ENGLAND AND WALES, 1900 TO 1902, BY AGE GROUPS.

[From Part II, Supplement to the Sixty-fifth Annual Report of the Registrar-General of Births, Deaths, and Marriages in England and Wales.]

Age at death.	Mortality from consumption.				Mortality from other diseases of the respiratory system.			
	Death rate per 1,000 for all occupied males.	Death rate for millers.			Death rate per 1,000 for all occupied males.	Death rate for millers.		
		Rate per 1,000.	Greater (+) or less (-) than rate for all occupied males.	Ratio to rate for all occupied males.		Rate per 1,000.	Greater (+) or less (-) than rate for all occupied males.	Ratio to rate for all occupied males.
15 to 19 years.....	0.54	.014	-0.40	26	0.24	0.14	- 0.10	58
20 to 24 years.....	1.55	.82	- .73	53	.48	.47	- .01	98
25 to 34 years.....	2.03	.86	-1.17	42	.77	.73	- .04	95
35 to 44 years.....	2.74	2.41	- .33	88	1.66	2.06	+ .40	124
45 to 54 years.....	3.04	2.16	- .88	71	3.32	4.13	+ .81	124
55 to 64 years.....	2.16	2.05	- .11	95	6.54	8.64	+ 2.10	132
65 years and over.....	1.11	2.18	+1.07	196	17.77	29.66	+11.89	167

The foregoing comparison shows that the mortality from consumption was excessive by 96 per cent at ages 65 and over, and that the mortality from respiratory diseases was excessive by 24 per cent at ages 35 to 54, by 32 per cent at ages 55 to 64, and by 67 per cent at ages 65 and over. The excess in the mortality at these ages from respiratory diseases is decidedly significant. This excess is confirmed by the corresponding statistics of Scotland, which also exhibit a high death rate from all causes at ages 45 and over and a considerable excess in the proportion of deaths from respiratory diseases at all ages. Out of 102 deaths of millers at ages 25 to 64 the proportion of deaths from consumption was 10.8 per cent, from bronchitis 12.7 per cent, from pneumonia 8.8 per cent, and from other respiratory diseases 2.0 per cent, a total of 34.3 per cent of deaths from diseases of the lungs and air passages.

Some very interesting vital statistics of millers have been made public for Switzerland for the period 1879 to 1890. Since in that country the patent-roller process has not made the progress which it has in England and in the United States, the exposure of the operatives is much greater to the inhalation of fine flour dust. The statistics of Switzerland are set forth in tabular form, as follows, exhibiting the mortality of millers from consumption:

MORTALITY FROM CONSUMPTION AMONG MILLERS, COMPARED WITH THAT OF ALL OCCUPIED MALES IN SWITZERLAND, 1879 TO 1890, BY AGE GROUPS.

[Figures from Vital Statistics of Switzerland, 1871 to 1890, Part III.]

Age at death.	Death rate per 1,000 for all occupied males.	Death rate for millers.		
		Rate per 1,000.	Greater (+) or less (-) than rate for all occupied males.	Ratio to rate for all occupied males.
15 to 19 years.....	1.30	1.23	-0.07	95
20 to 29 years.....	3.04	1.42	-1.62	47
30 to 39 years.....	3.66	3.02	-0.64	82
40 to 49 years.....	3.65	5.18	+1.53	142
50 to 59 years.....	3.52	6.49	+2.97	184
60 to 69 years.....	3.25	5.47	+2.22	168
70 years and over.....	1.84	7.11	+5.27	386

According to this table, the mortality of millers from consumption was below the average at ages under 40, but materially above the average at all ages 40 and over, the excess having been 42 per cent at ages 40 to 49, 84 per cent at ages 50 to 59, 68 per cent at ages 60 to 69, and 286 per cent at ages 70 and over. In a comparison of this kind, the material differences in the social and economic conditions of labor must, of course, be taken into account, and the vast differences in the mortality resulting from the important factors of race, nationality, climate, etc., but when these factors are allowed for, and with a due

regard for what is generally known of the mortality of Switzerland, the excess in the death rate from consumption among flour millers is very significant, and, in all probability, the direct result of the occupation.

The recorded industrial insurance mortality statistics of millers include 256 deaths from all causes, of which 40, or 15.6 per cent, were from consumption. Of the mortality of millers from respiratory diseases other than consumption, 29 deaths were from pneumonia, 7 from asthma, 4 from bronchitis, and 1 from other respiratory diseases. If the deaths from consumption and from other respiratory diseases are combined, 31.6 per cent of the mortality of millers was from diseases of the lungs and air passages. The number of deaths of millers under consideration is sufficiently large and fully representative of this occupation in the United States. The excess in the consumption death rate of millers is more clearly brought out in the tabular presentation of the proportionate mortality from this disease by divisional periods of life. While the consumption mortality was excessive at all ages under 65, the excess was most pronounced at ages 25 to 34, when out of every 100 deaths of millers from all causes 87.5 were from consumption, against a normal expected proportion of 31.3. Unfortunately, at this period of life the actual number of deaths under consideration is too small for a safe conclusion. The analysis of the consumption mortality of millers in detail is set forth in the table below:

PROPORTIONATE MORTALITY FROM CONSUMPTION AMONG MILLERS, 1897 TO 1906, COMPARED WITH THAT OF ALL MALES IN THE REGISTRATION AREA OF THE UNITED STATES, 1900 TO 1906, BY AGE GROUPS.

[Figures for millers from experience of an industrial insurance company; figures for males in registration area computed from mortality statistics of the United States census.]

Age at death.	Deaths of millers, 1897 to 1906, due to—		Per cent of deaths due to consumption among—	
	All causes.	Consump- tion.	Millers.	Males in registration area, 1900 to 1906.
15 to 24 years.....	7	2	28.6	27.8
25 to 34 years.....	8	7	87.5	31.3
35 to 44 years.....	27	8	29.6	23.6
45 to 54 years.....	39	11	28.2	15.0
55 to 64 years.....	64	9	14.1	8.1
65 years and over.....	111	3	2.7	2.7
Total.....	256	40	15.6	14.8

The preceding observations and vital statistics of millers are not entirely conclusive, but the evidence is sufficiently convincing to warrant the conclusion that the inhalation of flour dust is injurious to

health and that in proportion as the degree of dust inhalation is diminished the health and mortality of the operatives will improve. Perhaps the most conclusive statistics are the recorded industrial insurance experience data, which exhibit a decidedly high proportionate mortality from consumption at the earlier ages. The entire subject requires to be more thoroughly investigated, especially in the cities of the Northwest, where the flour-milling industry is of large proportions; but the introduction of the modern patent-roller process has largely eliminated the most health-injurious factors inherent in the work of the miller of an earlier date.

BAKERS AND CONFECTIONERS.

The census report on occupations for 1900 returned the number of bakers in the United States as 79,407, and the number of confectioners as 31,242, a total of 110,649, including among bakers 4,346 women and among confectioners 9,219. According to the census statistics of manufactures for 1900, the manufacture of bread and other bakery products was carried on in 14,917 establishments, employing 60,271 wage-earners. The rapid progress in the industry is indicated by the fact that the number of wage-earners in bakeries considered as manufacturing establishments increased from 22,488 in 1880 to 38,841 in 1890 and to 60,271 in 1900. Corresponding progress has been made in the manufacture of confectionery. In 1900 there were 4,297 manufacturing establishments, employing 33,583 wage-earners. The average number of employees was 21,274 in 1890 and 9,801 in 1880.

Employment in bakery and confectionery manufacture involves comparatively few objectionable factors, but both the labor and health conditions are, as a rule, unsatisfactory unless subject to rigid factory inspection and sanitary control. The process itself requires no extended explanation to emphasize the conditions more or less injurious to health. The work is chiefly divided into bread or pastry making proper and the subsequent process of baking, and while in the former there is considerable and continuous exposure to dust, in the latter there is exposure to both dust and extremes of temperature. Modern processes of bread making by machinery, and in particular the manufacture of confectionery and crackers, have eliminated to a considerable extent the risk of dust inhalation, since most of the operations are automatic and the hand does not touch the finished product at any stage of the manufacturing process. These improvements, however, do not affect a very large proportion of the men employed in bakeries and in the manufacture of confectionery on a small scale throughout the numerous small towns and villages of the country. The sanitary condition of bake shops has attracted the

attention of health authorities for many years, and in many respects there has been a decided improvement as the result of effective provisions of the sanitary codes of large cities. Underground bake-houses have been prohibited and in others sanitary improvements have been introduced, which, combined with rational labor legislation, have materially improved the health conditions under which the work of the baker and the confectioner is carried on at the present time.

The health of bakers within recent years has attracted special attention on account of the enactment in 1897 by the State of New York of a law limiting the hours of work in bakeries to 60 a week, or to not more than 10 in any one day, on the ground that excessive hours of labor in this particular employment were decidedly injurious to health. Chief Judge Parker, in giving the opinion of the court in the case of *People v. Lochner*, quoted from the well-known case of *People v. Havnor* (149 N. Y., 195), involving the constitutionality of the Sunday barber law, and accepted the view expressed by Judge Vann in that case that—

According to the common judgment of civilized men, public economy requires, for sanitary reasons, a day of general rest from labor, and the day naturally selected is that regarded as sacred by the greatest number of the citizens, as this causes the least inconvenience through interference with business. It is to the interest of the State to have strong, robust, healthy citizens, capable of self-support, of bearing arms, and of adding to the resources of the country. Laws to effect this purpose, by protecting the citizen from overwork and requiring a general day of rest to restore his strength and preserve his health, have an obvious connection with the public welfare.^(a)

Considered from this point of view it was largely a question of evidence tending to prove the conditions of labor and life in bakeries sufficiently injurious to health to warrant the drastic extension of the police powers of the State to this particular employment. That the facts bearing upon the health of the employment had been carefully considered by Chief Judge Parker is made evident by his concluding remarks that—

Again many medical authorities classify workers in bakers' or confectioners' establishments with potters, stonecutters, file grinders, and other workers whose occupation necessitates the inhalation of dust particles, and hence predisposes its members to consumption. The published medical opinions and vital statistics bearing upon that subject standing alone fully justify the section under review as one to protect the health of the employees in such establishments, and it is the duty of this court to assume that the section was framed not only in the light of, but also with full appreciation of the force of the

^a Fourth Annual Report of the Commissioner of Labor of New York for the twelve months ended September 30, 1904, p. 118.

medical authority bearing upon the subject—authority which reasonably challenges the attention and stimulates the helpfulness of the philanthropist.^(a)

In the opinion rendered by Judge Vann, one of the associate judges of the court of appeals, who concurred in the opinion reached by the chief judge, even more extended consideration is given to the medical aspects of the case and extended quotations are made from the writings of standard authorities on the diseases of occupations. The evidence quoted by Judge Vann fully confirms the view that working in a bakery or candy factory is an unhealthful employment when conducted in disregard of sanitary requirements. Judge Vann laid down an important principle in rendering his opinion, holding that “necessarily in considering the subject we may resort to such sources of information as were open to the legislature;” and, he continues, “vital statistics show that those vocations which require persons to remain for long periods of time in a confined and heated atmosphere filled with some foreign substance, which is inhaled into the lungs, are injurious to health and tend to shorten life.” Among these employments he included “bakers and confectioners, who during working hours constantly breathe air filled with the finest dust from flour and sugar,” and who, as such, have a tendency to consumption. After quoting from standard authorities, to which subsequent reference will be made, Judge Vann concluded his opinion with the statement that—

While the mortality among those who breathe air filled with minute particles of flour is less than among those who work in stone, metal or clay, still it seems to be demonstrated that it is greater than in avocations generally. The dust-laden air in a baker's or confectioner's establishment is more benign and less liable to irritate than particles of stone or metal, hence, while bakers are classed with potters, stone masons, file grinders, etc., still they are regarded as less liable to pulmonary disease than other members of the class. The evidence while not uniform leads to the conclusion that the occupation of a baker or confectioner is unhealthy and tends to result in diseases of the respiratory organs.^(b)

The earliest writer on the diseases of bakers was Ramazzini, who, in 1670, observed that “in sifting the flour, in kneading it into dough, and in baking that in the oven, they are in all these steps exposed to infinite fatigue and toil, and so brought under the lash of various diseases.”^(c) He called attention to the evils of night work, which is practically inseparable from the industry, and which in itself con-

^a Fourth Annual Report of the Commissioner of Labor of New York for the twelve months ended September 30, 1904, p. 124.

^b *Idem*, p. 129.

^c Treatise of the Diseases of Tradesmen, Ramazzini, English edition of 1705, p. 143.

stitutes a menace to health and in all probability a predisposing factor to consumption.

Attention was also called by him to a fact which has been brought out by practically every subsequent investigation, that bakers in large cities are not so healthy and long lived as are those in the small towns or in the country. "I have observed," he wrote, "that the bakers of large, populous cities, the inhabitants of which choose rather to buy than to make their own bread, are oftener sick than those of small towns and villages, where almost everyone bakes for themselves."^(a)

Thackrah, in his treatise on diseases of occupation, printed in 1832, confirms the observations of Ramazzini, stating that—

Bakers are generally pale and unhealthy. The temperature in which they are placed is seldom below 80° and often as high as 100°. The heat of the oven is rarely lower than 180°. Bakers are subject to disorders of the stomach, to cough and rheumatism. The two former of these affections arise, I conceive, from the dust which is largely inhaled.^(b)

In conclusion Thackrah comments upon the evil consequences of night work, in his opinion as injurious to health as the exposure to dust.

In 1855 an important report on The Laws and Ordonnances in Force in France for the Regulation of Noxious Trades and Occupations, by Dr. Waller Lewis, was published by the British Government, in which the health-injurious consequences of work in bakeries are considered at considerable length. The necessity for sanitary regulation is emphasized, it being pointed out that at that time, generally speaking, bread was made in cellars—narrow, badly ventilated, and impossible to be kept clean; and upon these grounds, it is argued, "it would be very desirable that the influence of authority should hasten to propagate improvements already accomplished in this art." With regard to the health of bakers, it is observed by Doctor Lewis that—

The profession of baker, known generally as a very unhealthy one, is, however, less so than it has been said to be. The bakers' assistants, divided into "brigadier" who shapes and places in the furnace, into "geindre" who kneads, and into "aide" or assistant, who heats the ovens and helps the principal workmen, are exposed, some to the excessive heat of the furnace, others to the very severe labor of working the dough, and to the dust given off from the flour. The operations of bakers take place at night. And without taking into consideration any influence that a night life may exert on the physical and

^a Treatise of the Diseases of Tradesmen, Ramazzini, English edition of 1705, p. 156.

^b Effects of Arts, Trades, and Professions on Health and Longevity, by C. Turner Thackrah, 1832, p. 133.

moral constitution of man, an influence reduced to its just proportions by Mr. Turner Thackrah, we can not but acknowledge that there are objections to the great changes of temperature, which must be felt after his work at the oven, or after kneading, by the workman who exposes himself to the morning's cold. Rheumatic affections, and acute inflammations of the chest, are in fact, as Ramazzini had already pointed out, those which most frequently attack bakers. In a report of the Institute of Hamburgh, quoted by Thackrah, it is stated that acute rheumatism attacks one-sixth of the bakers, while it only shows itself in one-fifteenth of the tailors. Everyone also has remarked the pallor so strongly characteristic of bakers' journeymen. It must be attributed particularly to that anæmic condition peculiar to all artisans who live in a very hot atmosphere. This influence, in conjunction with the smell given off by heated paste, doubtless contributes to predispose bakers to dyspepsia, which frequently, also, the habits of drunkenness and disorder, well known to be common to them, determine.^(a)

The report cites various authorities more or less conflicting as to the effect of the employment on health. According to one statement, out of 2,800 bakers deceased in ten years only 57 had died of tuberculous affections. While in one cholera epidemic a large number of bakers had died, in another epidemic bakers figured only in a proportion very inferior to that of a number of other professions understood to be much more salubrious than that of baking. Of course, at this early period the statistical evidence was neither trustworthy nor extensive.

There is a discussion of this employment in an article on the "Mortality in trades and professions," published in 1860 in one of the periodicals of the day, from which the following is quoted:

The baker is subjected to a still greater number of debilitating influences as regards his health than the tailor. In all cases his place of work is in a confined basement, where the oven and the gas contrive to keep the temperature at a tropical point. . . . The air, already foul enough, has yet to be contaminated with the floating flour dust so irritating to the fine air passages of the lungs. In an atmosphere thus deliberately poisoned with the elements of sickness, the journeyman baker is confined ordinarily from 7 o'clock at night until 4 the following morning, and towards the end of the week he is engaged nearly two entire days in succession. Is it surprising that their rate of sickness is dreadful—greater than even that of the tailors? Doctor Guy tells us that no less than thirty-one in the hundred spit blood, and that every other journeyman of the low-priced bakers, who work under still worse conditions, is subjected to this most dangerous disease. We feel convinced that the public can not be aware that they eat their daily bread at the expense of the life-blood of the producers. Parliament has refused to interfere in their behalf, but Lord Shaftesbury has taken up their cause, and we be-

^a Report on the Laws and Ordonnances in Force in France for the Regulation of Noxious Trades and Occupations, London, 1855, p. 65.

lieve that ere long the force of public opinion will lead to the abolition of the nightwork, which is at the bottom of the evil. At all events, those who wish to assist in the emancipation of these slaves of civilization will see with pleasure the introduction of the aerated bread, which by the aid of machinery manufactures the loaf in a much more cleanly method than by hand labor, and performs the whole process in less than an hour. The introduction of machinery into this trade will at once cure the evils complained of, which result in the majority of cases from the confined establishments and insufficient means of the master bakers.^(a)

The conditions affecting the health and life of men in this employment must necessarily vary with different countries and localities, according to the state of sanitary and labor legislation. If there is, therefore, conflict of opinion between continental, English, and American authorities, the foregoing fact has to be kept in mind in giving due weight to the relative importance of the authorities cited. Hirt, who probably more than any other writer on the diseases of occupation ascertained for himself the actual conditions of labor and life, was inclined to take a more favorable view of the baker's employment than of that of the miller, although the general mortality and disease frequency among the former was greater than among the latter. This difference, however, was chiefly accounted for by the higher degree of frequency in the occurrence of pneumonia among millers, for when phthisis, asthma, and bronchitis are combined the difference in the degree of frequency of these diseases was comparatively slight. Of 100 cases of sickness among bakers, phthisis caused 7 per cent, against 10.9 per cent among millers; asthma caused 1.9 per cent, against 1.5 per cent for millers; bronchitis caused 10.9 per cent, against 9.3 per cent among millers, while pneumonia among bakers caused 8.4 per cent, against 20.3 per cent among millers. Hirt concluded that because of the fact that bakers were more exclusively exposed to flour dust in a very fine form, as contrasted with the more general exposure of millers to grain dust, the liability to phthisis was less, with a corresponding lower mortality from this disease. He was further of the opinion that confectioners were more liable to consumption, the proportions being 11.6 per cent for consumption and 3.3 per cent for asthma, both relatively higher than in the case of bakers. There, however, was a somewhat less liability to bronchitis, or 8.4 per cent, against 10.9 per cent for bakers and 9.3 per cent for millers.

The observations of Hirt were made, of course, at a time when conditions in the industry were very different from what they are at the present day.

^a "Mortality in trades and professions," by Andrew Wynter, M. D., published in *Curiosities of Civilization*, p. 524.

B. W. Richardson took a more serious view of the health-injurious effects of flour dust, using the term "miller's asthma" to emphasize the peculiar effects of flour dust as a predisposing cause of a special form of respiratory afflictions.

In further illustration of the differences in local conditions which require to be taken into account when utilizing the available information regarding the health of persons employed in bakeries and in the making of confectionery, the following remarks are quoted from a course of lectures on public health before the Royal Dublin Society, published in 1874:

The baker suffers from the entrance of dust into his lungs, but more from the circumstances just named. In Dublin in 1859 his work hours averaged seventeen, beginning on Sunday afternoon about 4 o'clock, and he slept usually on the empty sacks, or in a bedroom over the bakehouse, where the carbonic acid of the air was excessive. For a wonder, Ireland was for once before England in sanitary legislation, as regards the baker, the 1 and 2 Victoria, chapter 28, prohibiting any baking process on Sunday, except the setting of Monday's sponge. Doctor Guy, of King's College, London, described several of the bakehouses in the metropolis as underground, without daylight, pervaded by sulphurous and worse smells, often flooded, and overrun with rats. One was not high enough for a man 5 feet 9 inches to stand erect in. It was no wonder that one-third of the London bakers habitually spat blood. Good example in Scotch towns, and in Belfast, and dignified agitation, procured the Bakehouse Act, 1863, which provides for the frequent cleaning of the premises, a wholesome sleeping room, and the exclusion from work, between 9 p. m. and 5 a. m., of all lads under eighteen. Unfortunately the carrying out of the act is not left to the factory inspectors, and I fear it is much neglected in some towns. The evils of the night work are still deplorable, and if the men took nights alternately in setting the sponge, the other journeymen surely could be spared between the afternoon and four the next morning. Some years ago I found hours in flour mills even more exacting, the dust more hurtful, and there was Sunday labor in those worked by water. Last week one of our newspapers had a letter, signed "A White Slave," which complained that in small confectionery shops the female bakers had to work over thirteen hours daily, and in dark cellars most usually.^a

Doctor Guy's observations are of particular interest because few English authorities examined into the facts of artisans' diseases during the earlier period with more care and deliberation. He was strongly in favor of substituting machinery for hand work, holding that a kneading machine, even of the rudest construction, not only would produce better bread but would prove of incalculable value in safeguarding the health of the employees. After pointing out the extremely insanitary condition of London bake shops, Doctor Guy

^a "Prevention of artisans' diseases," by E. D. Mapother, M. D., Lectures on Public Health, Royal Dublin Society, 1874, p. 142.

observed that "certainly here is a case in which Parliament might depart from established rules and interfere with the course of private business in order to prevent the wholesale sacrifice of human life."

In the *Insurance Times* for September, 1877 (p. 586), there appeared a translation of an article on "Life insurance for bakers," with special reference to German conditions, in which it is stated that—

There are various circumstances which render a baker's business, as it is carried on at the present day in a large part of Germany, unwholesome and destructive; the mere introduction of machinery would not entirely remove the difficulty. Kneading machines have long been in use in all the larger bakeries, and the unwholesome character of baker's work has not been altered. Flour dust, carrying heavy bags, often weighing more than 200 pounds, the heat of the rooms, and above all the fierce glow from the oven, taken together, are enough to ruin the strongest lungs, sooner or later. Want of sleep is what does bakers as much harm as anything; in many parts of Germany no journeyman is ever able to get, on the average, more than four hours' sleep.

Arlidge, in 1892, considered the employment of bakers and confectioners at considerable length, chiefly, of course, with reference to English conditions, which in the intervening period of time have been improved materially as the result of effective sanitary and factory legislation. Arlidge sums up his conclusions in the following statement, which includes a few references to the statistical researches of Doctor Ogle and others concerning the mortality in these occupations:

Bakers, confectioners, and pastry cooks represent a body of tradesmen exhibiting hygienic conditions of a common character, the principal of which are: Exposure to heat from the ovens, dust, steam, variations of temperature, in too many instances unhealthy bake-houses, fatiguing movements necessitated where kneading is done by hand, disagreeable emanations from materials used, prolonged hours of work, more or less night work and loss of rest. To these evils of their trade the working bakers often add intemperance and irregular living. My own senses also make me conscious of a disagreeable sickly smell, much like that of heated bones, superadded to the steam and other fumes. There are, in brief, many incidents in the occupation of baking, which reduce vital energy, predispose to lung affections, and shorten life. But we ought to distinguish between master and journeyman bakers. The former are mostly fat and flourishing, whilst the latter are anæmic and sallow, in general appearance worn-out, and in mental features dissatisfied and despondent.^(a)

With reference to the mortality of bakers as compared with that of men employed in other industries, and the particular liability to special diseases resulting from the trade, Arlidge wrote as follows:

The death rate of bakers, pastry cooks and confectioners, although still ruling high, has fallen of late years in a slight degree * * *.

^a Diseases of Occupations, by J. T. Arlidge, pp. 144, 145.

That of millers is almost exactly the same. The returns of the causes of mortality point to the abuse of alcoholic drinks by bakers. Deaths by suicide are in a very high ratio, but as regards phthisis and respiratory diseases, these tradesmen do not surpass the average for all males. Doctor Ogle adds: "Judging from the death rates of millers and bakers, the inhalation of flour dust would seem to be innocuous; probably little, if any, of the dust inhaled reaches the lungs." We feel obliged to differ from the learned writer on this point, there being ample evidence of flour entering the pulmonary tissue and setting up chest affections. In the vastly improved construction of flour mills, and by the introduction of automatic machines for grinding corn and separating it from its comparatively waste products, the evils of the miller's trade have been most materially reduced, yet withal not exterminated.

Those who have read the reports on the hygienic state of bake-houses, and the circumstances of labor in them, will not be surprised that the mortality of bakers ranges high. As to the exposure of bakers to flour dust, it is neither considerable in extent nor long in duration. Layet calls attention to the powerful and repeated movements imposed upon the men in kneading bread upon the old system; the forcible bending of the trunk forward, the pressure against the stomach, and the strength of arm called for. These actions, he asserts, cause heart disease and emphysema. Doctor Ogle's table partially bears out this conclusion. Thus, of 629 deaths, cardiac lesions were the cause in 86, or 13.6 per cent, certainly a somewhat high ratio; nevertheless little in excess of that occurring with shoemakers, with whom it equaled 12.4 per cent, although in the case of the latter there is an absence of very strong movements of the arms and trunk, other than those required in the act of stitching. Malgaigne assigned to bakers a high ratio of hernia, and others again speak of a remarkable susceptibility to fevers and epidemics, and to gastro-intestinal disorders. The last-named amount, according to Layet, to 20 per cent of the internal maladies they suffer; whilst in Hirt's experience of 100 cases of sickness among them, 28.2 per cent belonged to the respiratory apparatus. Lastly, Thackrah, really upon the authority of older writers, represents bakers as unusually subjects of rheumatism, an opinion we can not substantiate. Though some, chiefly among master bakers, get fat, the majority of these tradesmen are thin; and it is another prevailing phenomenon among them that they are anæmic. Layet quotes Mayer's statistics of the dimensions and weight of bakers drawn in the conscription in Bavaria, from which it appears that they were nearly at the bottom of the list among workmen taken from active occupations.^(a)

In 1892 the New Jersey bureau of labor reported the results of an inquiry into the trade life of bakers, including observations upon 933 bakers, 27.5 per cent of whom had entered the trade at an age below 16 years. Of the total number considered 73.3 per cent were foreign born, which is an important fact always to be kept in mind in considering trade mortality statistics. The effect of race and nativity is often of sufficient importance to invalidate conclusions

^a Diseases of Occupations, by J. T. Arlidge, pp. 146, 147.

based upon occupation mortality statistics alone. Of the 933 bakers, only 12, or 1.3 per cent, had attained to an age above 60 years, while only 48, or 5.1 per cent, attained to an age of from 51 to 60 years. The average number of years at work was 16.9, and of the total number under consideration 6.1 per cent were beginning to decline in health. Of those who were reported as declining in health, the number of which was 57, nearly one-half, or 47.4 per cent, gave the cause of decline as general debility, 22.8 per cent as rheumatism, 15.8 per cent as diseases of the throat and lungs (including catarrh), and in only one case was the cause of decline attributed to heat, and in one other case to overstrain. Out of the total number reported upon 74, or 7.9 per cent, had been from 30 to 39 years at work; 20, or 2.1 per cent, 40 to 49 years at work; and only 8, or 0.9 per cent, over 50 years at work. The foregoing statistical data would appear to confirm the general conclusions of medical authorities, but being limited to a single State, and to a comparatively small number of persons employed, the conclusions may not be entirely applicable to the United States as a whole.

With characteristic German thoroughness the entire subject was investigated and reported upon by Doctor Zadek, of Berlin, in 1896, who contributed a monograph on the hygiene of millers, bakers, and confectioners to the volume on occupation diseases of Weyl's Handbook of Hygiene, published in 1897. This monograph, with numerous illustrations, emphasizes the health-injurious circumstances of the employment, with special reference to labor conditions, including long hours and night work. The article mentions an elaborate inquiry by the German imperial department of labor statistics, which affords a clear insight into practically every phase of the employment considered as an industrial problem. A wealth of statistical data derived from various sources is considered in the discussion, all of which may be summed up in the statement that the evidence is entirely conclusive that the occupation of baker, unless subject to strict sanitary supervision, is decidedly prejudicial to health. Doctor Zadek refers to the interesting investigations by Fox into the mortality and diseases of the bakers' trade unions of London, including 4,400 members. Out of every 100 deaths from all causes among bakers, 24.4 per cent were from consumption and 36.6 per cent additional were from other diseases of the lungs and from bronchitis. These statistics apparently contradict those of Doctor Ogle, which gave a combined percentage of only 41.5, but it is explained that the records of trades unions are more trustworthy than information derived from general sources, including all employments classified as bakers from owners and masters to apprentices. The investigation by Fox indicates the necessity of extreme caution in accepting general statistics of occupation mortality, which in all probability, and almost

invariably, understate the actual facts of industrial diseases and industrial accidents.

Doctor Zadek also confirms the very early observations by Ramazzini that the mortality of bakers was higher in the cities than in the towns and villages. He mentions further that a rule is being enforced in the guilds to accept as apprentices only healthy young men, who first have to undergo a medical examination to determine whether they are adapted to the physical requirements, and if not so adapted they are declined. Doctor Zadek also includes statistical data for the sickness insurance associations of Berlin, proving that among bakers there was relatively much more sickness than among confectioners, there having been among the former 36.5 cases of sickness per 100 members, against 21.2 among the latter. The duration of sickness was 9.1 days for bakers against 4.6 days for confectioners. The statistical evidence, however, is somewhat conflicting and must be used with extreme caution. Early English statistics quoted by Doctor Zadek, in confirming other investigations, seem to prove that while the mortality of bakers below 40 years of age is normal, and perhaps somewhat below the average, the death rate is decidedly higher at ages over 50. This is confirmed by the investigations of Doctor Bertillon for the population of Paris during the period 1885 to 1889. Finally, Doctor Zadek observes that the evidence tending to prove health-injurious results of the employment is directly traceable to the excessive hours of labor, and particularly so in the case of bakers in large cities such as Paris, London, and Vienna. He anticipates satisfactory results from the progress of the industry within recent years, and the tendency toward the substitution of machinery for hand labor, but in particular from a maximum working day, prohibition of night labor, legal requirements of air, light, cleansing, and ventilation, and, finally, rigid factory inspection to conform the sanitary conditions of bakeries to those of modern sanitary requirements in general.

Another German authority on the hygiene of the bakery industry, Dr. C. Moeller, published a small treatise on the subject in 1898, including a careful consideration of all the important points considered at greater length by Doctor Zadek. According to the data presented by this writer of bakers dying between 45 and 65 years of age, 25 per cent died from chronic bronchitis or other respiratory diseases. He calls attention to the persistency of the flour dust and starchy particles in the bronchial tubes and even in the lungs, by quoting a medical authority to the effect that even two and a half weeks after leaving the employment starchy particles and other evidence of flour dust had been found in the expectoration of bakers examined. According to this same authority 47 per cent of the German bakers at that time worked over 12 hours a day and 16 per

cent worked over 14 hours a day. Of the total number of bakers employed, 36 commenced their work between the hours of 12 and 2 a. m., while 25 per cent commenced work between 10 and 12 p. m. In other words, at that time most of the work was night work, with its resulting injurious consequences, including irregularity of life and exposure to other unfavorable conditions.^(a)

In the United States the employment has not attracted the same amount of attention as in Europe, but the sanitary legislation governing the conduct of bake shops is evidence that the hygienic conditions have been far from satisfactory. It is quite probable that the conditions are somewhat better in this country than abroad, largely on account of the greater degree of concentration in the industry and the fact that a larger proportion of bread, crackers, pastry, etc., constitutes a factory product in this country than abroad. The general conclusions of foreign authorities are, however, strictly applicable to American conditions, and they may be summarized in the statement that the continuous and considerable inhalation of flour dust is injurious to health and a predisposing factor in the mortality from consumption and from respiratory diseases generally.

The number of male bakers 15 years of age and over in the United States, according to the report of the census on occupations for 1900, was 74,263, and of this number 1,813, or 2.4 per cent, were 65 years of age and over, which compares with 4.7 per cent for the entire male population of the continental United States. At ages 55 to 64 the proportion was 5.6 per cent, at ages 45 to 54 it was 11.3 per cent, leaving 80.7 per cent at ages 15 to 44, inclusive. The occupation is first referred to in the vital statistics of the census of 1890, when the number of bakers and confectioners in the registration area was 54,569, among whom there occurred 639 deaths from all causes, or 11.7 per 1,000. The death rate by divisional periods of life was comparatively high at all ages over 25, or, in detail, at ages 25 to 45 the rate was 11.19 for bakers, against 9.18 for males in manufacturing and mechanical industries; at ages 45 to 65 the rates were 28.45 and 20.13, respectively; and at ages 65 and over, 87.19 for bakers and confectioners and 77.67 for males in manufacturing and mechanical industries. In the registration area the mortality from consumption among bakers and confectioners during the census year 1890 was 2.91 per 1,000, and for diseases of the respiratory system, 2.0 per 1,000. But the rates were much higher in the cities where the mortality from consumption among bakers and confectioners was 3.89 per 1,000, while the mortality from diseases of the respiratory system was 2.80 per 1,000. In commenting upon the mortality, it is stated in the census report that—

It will be seen from this table that the highest death rate [per 100,000] of bakers and confectioners in the registration States oc-

^a Gesundheitsbuch für das Bäckergewerbe, by Dr. Carl Moeller, Berlin, 1898.

curred from consumption (369.37), the rate from this cause being higher than the average rate among males in occupations in this class. The death rate from Bright's disease (92.34) was excessively high, being nearly twice the average rate among males in this class (49.06), and the rate from other diseases of the urinary system (60.38) was considerably higher than the average rate of males in this class from these diseases (45.21). The death rate from suicide (21.31) was higher than the average rate from this cause among males in this class, and the death rate from other accidents and injuries (39.07) was much less than the corresponding rate in this class (77.49). The death rate of bakers and confectioners from suicide in the registration cities in the nonregistration States (30.29) was higher than the rate from this cause in the cities in the registration States (20.28).^(a)

In 1900 the number of bakers and confectioners reported in the registration States was 39,181, among whom there occurred 483 deaths from all causes, or 12.3 per 1,000. The death rates by divisional periods of life were slightly higher for bakers at all ages except 25 to 34. The differences were not very marked, or, to be specific, at ages 25 to 44 the rates were 7.9 for bakers, against 8.4 for males in the manufacturing and mechanical industries. At ages 45 to 64 the rates were 23.4 and 20.2, respectively, and at ages 65 and over 105.8 for bakers and confectioners and 105.4 for males in the manufacturing and mechanical industries. The mortality from consumption among bakers was 2.5 per 1,000, from pneumonia 1.2, and from other diseases of the respiratory system 0.4. In commenting upon the mortality, it is stated in the census report that—

The highest death rates [per 100,000] of bakers and confectioners were due to consumption (250.1), diseases of the urinary organs (145.5), diseases of the nervous system (160.8), and pneumonia (117.4), but the rates due to all of these diseases except diseases of the urinary organs were lower than the average rates in this class. The rates from diseases of the liver (45.9) and other diseases of the digestive system (58.7) were much higher than the average rates from these diseases in this class.^(b)

The Rhode Island vital statistics for bakers for the period 1852 to 1906 include 221 deaths from all causes, and of this number 44, or 19.9 per cent, were from consumption. During the decade ending with 1906 there occurred 86 deaths of bakers from all causes, of which 15, or 17.4 per cent, were from consumption. Of the mortality from other respiratory diseases 2.3 per cent were deaths from asthma and 9.3 per cent deaths from pneumonia, a total of 29 per cent of deaths from diseases of the lungs and air passages.

^a Report on Vital and Social Statistics, Part I, Eleventh Census of the United States, 1890, p. 119.

^b Report on Vital Statistics, Part I, Twelfth Census of the United States, 1900, p. cclxxviii.

The most recent English mortality statistics of bakers are for the three years ending with 1902, referred to in the Supplement to the Sixty-fifth Annual Report of the Registrar-General, in part, as follows:

At the earlier and later ages the mortality of bakers differs little from that of occupied and retired males, but that at other ages the death rates fall considerably below the average. In the main working period of life the comparative mortality figure was 922, or 8 per cent below the standard; the defect being mainly due to phthisis, to diseases of the circulatory and respiratory systems, and to accident, the mortality from the last-mentioned cause being less than half the average. Bakers experienced, however, a slightly higher mortality than the average from cancer.^(a)

In the table which follows, a comparison is made of the mortality from all causes among English bakers and confectioners with occupied males generally and the comparison shows that the mortality from all causes was below the average at every divisional period of life, except 55 to 64. English statistics in this respect, therefore, do not entirely confirm the corresponding statistics of the United States census.

MORTALITY FROM ALL CAUSES AMONG **BAKERS AND CONFECTIONERS**, COMPARED WITH THAT OF ALL OCCUPIED MALES IN ENGLAND AND WALES, 1900 TO 1902, BY AGE GROUPS.

[From Part II, Supplement to the Sixty-fifth Annual Report of the Registrar-General of Births, Deaths, and Marriages in England and Wales.]

Age at death.	Death rate per 1,000 for all occupied males.	Death rate for bakers and confectioners.		
		Rate per 1,000.	Greater (+) or less (-) than rate for all occupied males.	Ratio to rate for all occupied males.
15 to 19 years.....	2.44	2.26	- 0.18	93
20 to 24 years.....	4.41	3.80	- .61	86
25 to 34 years.....	6.01	5.28	- .73	88
35 to 44 years.....	10.22	8.69	- 1.53	85
45 to 54 years.....	17.73	16.11	- 1.62	91
55 to 64 years.....	31.01	31.04	+ .03	100
65 years and over.....	88.39	75.64	-12.75	86

The preceding table is self-explanatory and requires no further comment. A more extended comparison, however, is made in the next table, in which the mortality of bakers and confectioners from consumption and from other respiratory diseases during 1890 to 1892 is compared with the normal mortality of occupied males from these diseases by divisional periods of life. The comparison shows that the mortality of bakers and confectioners from consumption was excessive in only three age groups, 25 to 34, 45 to 54, and 65 and over, and was

^a Part II, Supplement to the Sixty-fifth Annual Report of the Registrar-General of Births, Deaths, and Marriages, p. lxii.

considerably lower than the average in the other groups. The table further shows that the mortality from other respiratory diseases was excessive in only two groups, 15 to 19 and 55 to 64. The mortality was considerably below the average at ages 20 to 44.

MORTALITY FROM CONSUMPTION AND FROM OTHER DISEASES OF THE RESPIRATORY SYSTEM AMONG **BAKERS AND CONFECTIONERS**, COMPARED WITH THAT OF ALL OCCUPIED MALES IN ENGLAND AND WALES, 1890 TO 1892, BY AGE GROUPS.

[From Supplement to the Fifty-fifth Annual Report of the Registrar-General of Births, Deaths, and Marriages in England and Wales.]

Age at death.	Mortality from consumption.				Mortality from other diseases of the respiratory system.			
	Death rate per 1,000 for all occupied males.	Death rate for bakers and confectioners.			Death rate per 1,000 for all occupied males.	Death rate for bakers and confectioners.		
		Rate per 1,000.	Greater(+) or less (-) than rate for all occupied males.	Ratio to rate for all occupied males.		Rate per 1,000.	Greater (+) or less (-) than rate for all occupied males.	Ratio to rate for all occupied males.
15 to 19 years.....	0.70	0.63	-0.07	90	0.26	0.28	+0.02	115
20 to 24 years.....	1.95	1.60	- .35	82	.61	.49	- .12	80
25 to 34 years.....	2.63	2.83	+ .20	108	1.13	.94	- .19	83
35 to 44 years.....	3.43	3.02	- .41	88	2.50	2.12	- .38	85
45 to 54 years.....	3.38	3.71	+ .33	110	5.15	5.05	- .10	98
55 to 64 years.....	2.65	2.44	- .21	92	10.32	10.49	+ .17	102
65 years and over.	1.50	1.86	+ .36	124	25.91	25.85	- .06	100

In the table which follows the mortality from consumption and from respiratory diseases other than consumption among bakers and confectioners for the years 1900 to 1902 is compared with the normal mortality of occupied males from these diseases by divisional periods of life:

MORTALITY FROM CONSUMPTION AND FROM OTHER DISEASES OF THE RESPIRATORY SYSTEM AMONG **BAKERS AND CONFECTIONERS**, COMPARED WITH THAT OF ALL OCCUPIED MALES IN ENGLAND AND WALES, 1900 TO 1902, BY AGE GROUPS.

[From Part II, Supplement to the Sixty-fifth Annual Report of the Registrar-General of Births, Deaths, and Marriages in England and Wales.]

Age at death.	Mortality from consumption.				Mortality from other diseases of the respiratory system.			
	Death rate per 1,000 for all occupied males.	Death rate for bakers and confectioners.			Death rate per 1,000 for all occupied males.	Death rate for bakers and confectioners.		
		Rate per 1,000.	Greater (+) or less (-) than rate for all occupied males.	Ratio to rate for all occupied males		Rate per 1,000.	Greater (+) or less (-) than rate for all occupied males.	Ratio to rate for all occupied males.
15 to 19 years.....	0.54	0.35	-0.19	65	0.24	0.29	+0.05	121
20 to 24 years.....	1.55	1.48	- .07	95	.48	.37	- .11	77
25 to 34 years.....	2.03	1.83	- .20	90	.77	.56	- .21	73
35 to 44 years.....	2.74	2.41	- .33	88	1.66	1.51	- .15	91
45 to 54 years.....	3.04	2.76	- .28	91	3.32	2.97	- .35	89
55 to 64 years.....	2.16	1.88	- .28	87	6.54	6.41	- .13	93
65 years and over.	1.11	1.02	- .09	92	17.77	15.60	-2.17	88

The comparison shows that the mortality from consumption was below the average at all ages and, with one unimportant exception, the mortality from other respiratory diseases among bakers and confectioners was lower than among occupied males generally. The table is self-explanatory and requires no extended analysis.

The corresponding statistics for Scotland exhibit a slightly different result. Limiting the comparison to ages 25 to 64, the general death rate of bakers and confectioners was in excess of the mortality of occupied males generally. The death rate among the former was 32.12 per 1,000, and among the latter 26.82. At ages 25 to 44 the mortality, however, was below the average, or only 7.99 for bakers and confectioners, against 9.32 for occupied males generally. The number of deaths from all causes among bakers and confectioners at ages 15 to 64 was 564, and of this number 104, or 18.4 per cent, were deaths from consumption. Of the mortality from other causes, 45 were deaths from bronchitis, 62 were deaths from pneumonia, and 8 were deaths from other respiratory diseases. Combining the mortality from consumption and other diseases of the respiratory organs, the proportionate mortality was 38.8 per cent.

In marked contrast to the generally favorable statistics of bakers and confectioners in England and Scotland are the returns for Switzerland for the period 1879 to 1890. The following table exhibits the mortality from consumption by divisional periods of life:

MORTALITY FROM CONSUMPTION AMONG **BAKERS**, COMPARED WITH THAT OF ALL OCCUPIED MALES IN SWITZERLAND, 1879 TO 1890, BY AGE GROUPS.
[Figures from Vital Statistics of Switzerland, 1871 to 1890, Part III.]

Age at death.	Death rate per 1,000 for all occupied males.	Death rate for bakers.		
		Rate per 1,000.	Greater (+) or less (–) than rate for all occupied males.	Ratio to rate for all occupied males.
15 to 19 years.....	1.30	1.30	.....	.....
20 to 29 years.....	3.04	2.75	–0.29	90
30 to 39 years.....	3.66	4.72	+1.06	129
40 to 49 years.....	3.65	3.96	+0.31	103
50 to 59 years.....	3.52	4.75	+1.23	135
60 to 69 years.....	3.25	5.92	+2.67	182
70 years and over.....	1.84	7.61	+5.77	414

According to this table, the mortality from consumption was excessive among bakers at all ages above 29 by from 8 per cent to 314 per cent. The most marked excess occurs at ages 70 and over, when, however, the small numbers partly invalidate the conclusions. The table, however, is suggestive as indicating possibly decided differences in the social condition of labor in England and in Switzerland.

The Swiss data are quite trustworthy, but their significance is, of course, practically limited to Switzerland.

The recorded industrial insurance mortality statistics of bakers include 1,357 deaths from all causes, of which 277, or 20.4 per cent, were from consumption. Of the mortality of bakers from respiratory diseases other than consumption, 124 were from pneumonia, 23 from bronchitis, 17 from asthma, and 21 from less frequent respiratory diseases. If the deaths from consumption and from other respiratory diseases are combined, it is found that 34 per cent of the mortality of bakers was from diseases of the lungs and air passages. The number of deaths of bakers under consideration is exceptionally large and strictly representative of this important occupation. The excess in the consumption mortality of bakers is clearly brought out in the tabular presentation of the proportionate mortality from this disease by divisional periods of life, it being excessive at all ages below 65, but most so at ages 25 to 34, when out of every 100 deaths from all causes, 42.8 were from consumption, against a normal expected proportion of 31.3.

An analysis of the consumption mortality of bakers in detail is set forth in the table below:

PROPORTIONATE MORTALITY FROM CONSUMPTION AMONG **BAKERS**, 1897 TO 1906, COMPARED WITH THAT OF ALL MALES IN THE REGISTRATION AREA OF THE UNITED STATES, 1900 TO 1906, BY AGE GROUPS.

[Figures for bakers from experience of an industrial insurance company; figures for males in registration area computed from mortality statistics of the United States census.]

Age at death.	Deaths of bakers, 1897 to 1906, due to—		Per cent of deaths due to consumption among—	
	All causes.	Consumption.	Bakers.	Males in registration area, 1900 to 1906.
15 to 24 years.....	112	43	38.4	27.8
25 to 34 years.....	201	86	42.8	31.3
35 to 44 years.....	259	75	29.0	23.6
45 to 54 years.....	248	43	17.3	15.0
55 to 64 years.....	250	23	9.2	8.1
65 years and over.....	287	7	2.4	2.7
Total.....	1,357	277	20.4	14.8

The preceding observations and mortality statistics, including the insurance experience, are much at variance with each other, and they do not entirely warrant definite conclusions. It is somewhat open to question how far the general official statistics are impaired in value by the inclusion of confectioners, who are probably less exposed to flour and other organic dust than bakers. The most convincing statistics are those for Switzerland and the industrial insurance experience data, both of which indicate an excess in the degree

of consumption frequency, although not at identical periods of life. Taking all the facts, however, into careful consideration, they would seem to warrant the conclusion that consumption is of more frequent occurrence among bakers than among occupied males generally, and that the degree of excess in consumption frequency is partly the result of continuous and considerable inhalation of flour dust. The mortality rate is also affected by the general conditions under which the work of a baker is carried on, including excessive hours, unsanitary conditions of bake shops, night work, etc. The occupation is exceedingly important, both as regards the baker himself and the public at large, and a further and more thorough investigation into the mortality of this occupation would be a most valuable contribution to industrial hygiene.

The mortality of confectioners is not separately returned in the official vital statistics, except for the State of Rhode Island. During the period 1852 to 1906 there occurred 62 deaths, and of this number 15, or 24.2 per cent, were from consumption. During the ten-year period ending with 1906 there occurred 24 deaths of confectioners, and of this number 4, or 16.7 per cent, were from consumption. In addition there were 6 deaths from other respiratory diseases, or a total of 41.7 per cent of the mortality was from diseases of the lungs and air passages.

The only other available official vital statistics of confectioners, separately returned as such, are for Switzerland for the period 1879 to 1890. The statistics are set forth in tabular form, as follows:

MORTALITY FROM CONSUMPTION AMONG CONFECTIONERS, COMPARED WITH THAT OF ALL OCCUPIED MALES IN SWITZERLAND, 1879 TO 1890, BY AGE GROUPS.

[Figures from Vital Statistics of Switzerland, 1871 to 1890, Part III.]

Age at death.	Death rate per 1,000 for all occupied males.	Death rate for confectioners.		
		Rate per 1,000.	Greater (+) or less (−) than rate for all occupied males.	Ratio to rate for all occupied males.
15 to 19 years.....	1.30	2.34	+ 1.04	180
20 to 29 years.....	3.04	6.19	+ 3.15	204
30 to 39 years.....	3.66	6.36	+ 2.70	174
40 to 49 years.....	3.65	3.58	− .07	98
50 to 59 years.....	3.52	6.00	+ 2.48	170
60 to 69 years.....	3.25	9.38	+ 6.13	289
70 years and over.....	1.84	13.51	+11.67	734

According to this table, the mortality from consumption was higher at nearly every period of life than the corresponding mortality of occupied males generally and the corresponding mortality of bakers. How far the occupation is the exact equivalent of the

English and American term confectioner, it is not possible to state. It is significant, however, to note the high death rates from consumption at every period of life, which only at ages 40 to 49 corresponds practically to the normal for occupied males generally.

The industrial insurance mortality statistics of this occupation include 306 deaths from all causes, of which 68, or 22.2 per cent, were from consumption. Of the mortality of confectioners from respiratory diseases other than consumption, 40 were from pneumonia, 7 from asthma and bronchitis, and 7 from other respiratory diseases. When the deaths from consumption and from other respiratory diseases are combined, it is found that 39.9 per cent of the mortality of confectioners was from diseases of the lungs and air passages. The corresponding proportion for bakers, previously referred to, was 34 per cent. This difference in favor of bakers is confirmed by the corresponding statistics for Switzerland, but when comparison is made of the differences by divisional periods of life it is apparent that the data are not sufficiently large for an entirely safe conclusion, to the effect that the degree of consumption frequency among confectioners is really higher than the corresponding degree of consumption mortality among bakers.

The detailed analysis of the industrial insurance mortality statistics of confectioners, by divisional periods of life, is set forth in tabular form as follows:

PROPORTIONATE MORTALITY FROM CONSUMPTION AMONG CONFECTIONERS, 1897 TO 1906, COMPARED WITH THAT OF ALL MALES IN THE REGISTRATION AREA OF THE UNITED STATES, 1900 TO 1906, BY AGE GROUPS.

[Figures for confectioners from experience of an industrial insurance company; figures for males in registration area computed from mortality statistics of the United States census.]

Age at death.	Deaths of confectioners, 1897 to 1906, due to—		Per cent of deaths due to consumption among—	
	All causes.	Consumption.	Confectioners.	Males in registration area, 1900 to 1906.
15 to 24 years.....	51	13	25.5	27.8
25 to 34 years.....	52	22	42.3	31.3
35 to 44 years.....	62	19	30.6	23.6
45 to 54 years.....	39	5	12.8	15.0
55 to 64 years.....	56	6	10.7	8.1
65 years and over.....	46	3	6.5	2.7
Total.....	306	68	22.2	14.8

It is to be kept in mind, in considering this occupation, that the amount of physical labor required is much less and that, therefore, a less robust type is represented by confectioners than by bakers. Probably few other occupations emphasize so clearly the inherent difficulty of drawing really valid conclusions from occupation vital

statistics of the comparative data of bakers and confectioners, representing otherwise quite similar employments. What is true of bakers is true of confectioners, that the hygienic conditions of this employment require to be made the subject of a qualified inquiry and that the available vital statistics should be brought together to establish clearly and precisely the degree of consumption frequency in this particular occupation by divisional periods of life.

STARCH MANUFACTURE.

The manufacture of starch, according to the census of 1900, gave employment to 2,655 wage-earners in 124 establishments, but it is quite probable that the actual number of persons employed in the manufacture of starch is larger, and perhaps much larger, when persons employed in the manufacture of starch in glucose factories are included. The commercial importance of this industry is considerable, but apparently there has been a material decline in both the amount and the value of the product during recent years. According to the census of manufactures, in 1905 the amount of starch made was 196,074,530 pounds, against 297,803,139 pounds in 1900. Of the total product 76.8 per cent was made from corn, 14.1 per cent from potatoes, and the remainder from other materials. The time of employment in cornstarch factories is generally throughout the year, while in the manufacture of starch from potatoes the period of employment is about three months only. There are a few wheat starch factories, which, however, probably employ less than a hundred persons. Most of the cornstarch factories are combined in the National Starch Manufacturing Company, with 22 plants, and its principal factory at Oswego, N. Y.

The process of starch manufacture varies, and is rather difficult of brief description. In the manufacture of cornstarch the corn is run through a fanning mill to blow away the dust, husks, etc., and is then steeped in water at from 70° to 140° F. from three to ten days, when the softened grains are crushed between rolls. This process, according to Thorp, is known as the "alkaline process." In the so-called "Burgen system" a continuous stream of water at 130° to 140° F. flows slowly through the steeping tanks, and after the corn has been thoroughly softened and a large quantity of extracted matter has been washed away, the corn is ground in buhrstone and roller mills, through which water flows continuously. Subsequent to this the starchy matter goes to a revolving sieve of brass wire for the coarsest straining and then to cylindrical wheels covered with bolting cloth. The subsequent process is described as follows:

The starch collected in the several tanks is washed with water and sometimes again siphoned, and is then run through bolting cloth to the settling tanks, where it deposits in a dense compact layer from

which the water can be drawn off very completely. The wet starch is then shoveled into frames lined with cloth and having perforated bottoms, through which the water drains. The cake of damp starch is cut into smaller blocks and placed on porous floors of plaster of Paris or brick, which absorb the adhering water. The starch is removed to the dry room and kept at a temperature of 125° F. for several days. While it is drying, the impurities still remaining in it find their way to the surface, where they form a yellowish deposit which is cut away when the starch is nearly dry. The block is then wrapped in paper and further dried at 150° to 170° F. for several days. During this time the mass contracts and cracks into a number of irregularly shaped prismatic rods, called "crystals," though they are not true crystals. The entire drying process requires several weeks, and the product as sent to market contains about 10 to 12 per cent of water.^(a)

It is in the handling of the corn itself and in the final manipulation of the dry starch that there is considerable exposure to dust, the character of which quite closely resembles ordinary flour dust, and which, broadly speaking, makes the health-injurious circumstances of this employment conform to those of flour millers and bakers. While the conditions differ somewhat, according to the material from which the starch is made, whether corn, potatoes, wheat, rice, etc., the exposure to starch dust is practically the same. The employment has never attracted much attention as a health-injurious industry, and general vital statistics of the occupation, even if available, would be of small determining value, since it is practically among only the persons employed at the drying kiln and in the handling of the finished product, either by transporting it from the kiln to the packing room or in the final process of packing the starch into barrels and boxes, that there is any actual exposure to the inhalation of any quantities of starch dust. The various processes of starch manufacture have been briefly described in a bulletin of the Twelfth Census by Dr. H. W. Wiley, and by the same authority in Bulletin No. 58 of the Division of Chemistry of the United States Department of Agriculture, but the descriptive accounts do not throw much light upon the possible health-injurious circumstances of the industry in its various branches.

The occupation is very briefly described by Ramazzini, who states that "those who are employed about the making of starch are likewise liable to uncommon disorders." Of course in Ramazzini's time the manufacture of starch was entirely a domestic industry, with conditions totally different from those prevailing at the present time. He observes, however, that those who are compelled to handle starch in considerable quantities complain much about headache, of a difficulty of breathing, and of a cough "that's so troublesome as to force 'em to intermit for fear of choking."

^a Outlines of Industrial Chemistry, by F. H. Thorp, Ph. D., pp. 355, 356.

Thackrah^a considered the employment at greater length, observing that—

Starch makers inhale a fetid acetous vapor, which rises from the fermenting wheat, or rather from the water in which the wheat has been steeped. They are occasionally exposed, also, to great heat, the thermometer rising from 110 to 150, or sometimes even to 200 degrees. In that degree of heat, however, the men do not remain more than a few minutes at once; but they often work the whole day in a temperature above 100 degrees. More frequently, however, they are employed in rooms, wet, and open to currents of cold air. The manufacture is carried on by night, as well as day; but the men do not generally work more than twelve hours in the twenty-four. The muscular labor is varied and good.^(a)

With special reference to the liability of starch makers to pulmonary and respiratory diseases, Thackrah remarks:

Starch makers are subject to catarrh, pulmonic inflammation, and rheumatism. In the neighborhood of London they are pale and emaciated, complain of great debility, and are often affected with pains in the head and chest; but in the country these effects are by no means prominent.^(b)

In Lincolnshire and Yorkshire, according to the same writer, the longevity of starch makers was apparently normal and men were met with who had attained to the age of 60 and upward. But in London and its neighborhood the health of starch makers was apparently decidedly unfavorable and the duration of life “remarkably abbreviated.”^(b)

In fact he was able to find few persons employed in this industry who had attained to an age over 40, and from such inquiries as he had made very few indeed, “after leaving the employment about that age, survived more than two or three years.” Thackrah was unable to account for the difference in the health of starch makers in London compared with those in country towns, for the conditions of labor and exposure to dust, etc., were assumed to be practically the same.

Halford, in his treatise on the diseases of artisans, published in 1845, referred briefly to the employment, and while he mentions that the pulverizing processes gave rise to a considerable quantity of dust he does not connect the same with any health-injurious consequences to the employees. Halford considered the occupation chiefly with reference to the manufacture of wheat starch, and the only injurious factors, in his opinion, were vaporous exhalations, giving rise to diseases of the respiratory organs, but he points out that even at that

^a Effects of Arts, Trades, and Professions on Health and Longevity, by C. Turner Thackrah, 1832, pp. 52, 53.

^b Idem, p. 53.

time improvements were being introduced in the methods of manufacture, eliminating formerly objectionable conditions.

Equally brief is the consideration of this employment by Hirt. He mentions the objectionable features of gases and vapors evolved in the preliminary processes of starch manufacture; but, apparently, no health-injurious consequences were traceable to such exposure. Hirt, who personally inquired into the subject, did not confirm the earlier conclusions of Halfort. The drying of the starch, in which there is practically the only serious possibility of dust exposure, was not considered detrimental to health by Hirt; but, apparently, he did not thoroughly inquire into this particular branch of the industry.

The most recent writer on the hygiene of starch making is Arlidge, who made inquiry at the principal starch works of England; but the information received was all of a negative character. In the opinion of the manufacturers, based partly upon the observations of medical officers attached to the works, there were no injurious results from any branch of the occupation. In fact, the conclusions were to the effect that "the starch makers are, it appears, even more healthy than the workers in other departments of the factory, judging from the fact that the claims of those workmen upon the 'sick fund' are proportionately smaller than those of others." Arlidge, however, suggests that it is to be borne in mind that exposure to dampness is a conspicuous incident and a possible cause of illness, more serious than exposure to flour dust in the business of starch making, for, he remarks, "Vast quantities of water are necessitated, with unavoidable exposure to wetting of clothes and feet; and, as a necessary accompaniment, a more or less humid state of the air." No evidence, however, was obtainable to prove that starch workers were more liable than others to rheumatic affections. Unfortunately, the final suggestion of Doctor Arlidge, that a more thorough inquiry be made to determine the possible health-injurious effects of the inhalation of flour dust and the general consequences of starch making on health, confirmed by precise and statistical investigations, was, apparently, not carried into effect.

The starch industry is one of the numerous illustrations of neglect on the part of those who have made inquiry into the diseases of occupation to ascertain the conditions of health in employments numerically unimportant. From such information, however, as is available at the present time it is safe to assume that the employment is not free from more or less health-injurious circumstances, which require sanitary supervision and the installation of effective ventilating devices at places where dust is generated in considerable quantities. That the quantity of dust may assume considerable proportions is made evident by the occurrence of disastrous dust explosions, and reference may be made to such an explosion at the dry starch

plant of the Warner Sugar Refining Company, at Waukegan, Ill., which destroyed the plant and caused the loss of four lives. This explosion was caused by the ignition of the fine dust, or powder, arising during the grinding of the starch, and while the case may be an isolated occurrence, it is nevertheless a significant illustration of the fact that starch manufacture requires to be included in the classification of dusty trades.

THE TOBACCO INDUSTRY.

The tobacco industry divides itself into the handling of the raw product preliminary to the subsequent processes of manufacture and into the making of cigars, cigarettes, snuff, etc., as the finished product. The former is more properly, perhaps, a branch of agriculture, but in any extended consideration of the hygiene of the tobacco industry it seems best to include the processes of curing, sorting, and packing previous to the shipment of the raw product to the factory.^(a) The number of persons employed in the preliminary processes can not be stated, but the large majority are at work for only a portion of the year (being mostly farmers and laborers), in very much the same manner as is the case in cotton ginning and during the threshing season in the wheat industry. After the tobacco has been cut it is first required to undergo a process known as curing. At this stage of the process there is no considerable exposure on the part of the workmen to any conditions particularly injurious to health. The curing is done in so-called tobacco barns,^(b) which are fairly tight, but are well provided with ventilators to furnish ventilation until the tobacco is thoroughly cured. Artificial heat may or may not be used in this process, which rarely extends over more than two months in the year. When the tobacco is thoroughly cured and the stems are

^a It is stated in the special report of the census office on manufactures for 1905 (Vol. I) that "Establishments engaged exclusively in the assorting, stemming, and rehandling of tobacco were omitted from the factory census of 1905, although included in prior censuses. When the assorting and stemming was done in connection with the manufacture of cigars and cigarettes, or of chewing and smoking tobacco, the data for these processes were included." This explains why the returns for 1905 are not strictly comparable with those for 1900 and previous censuses.

^b For an extended account of the widely varying methods of curing tobacco and a descriptive and illustrated account of the different types of tobacco barns, reference may be had to the special report of the Tenth Census on Culture and Curing of Tobacco in the United States. This report states that tobacco barns in North Carolina, for illustration, were built of logs, small and tight, of a usual size of 16 to 22 feet square (p. 116); while in Tennessee the usual size was from 20 to 24 feet square (p. 181); in contrast to these dimensions are the dimensions of the tobacco houses in Lancaster County, Pa., of from 20 feet square as a minimum to 40 feet wide and 150 feet long as a maximum, but a barn 36 feet wide by 72 or 80 feet long is considered to be the best proportioned (p. 156).

dried out it is again allowed to become slightly moist by absorbing moisture from the air and is taken down and placed in heaps, with sacks or cloths spread over them, to keep the tobacco in a moist condition; and to continue this condition sprinkling with water is occasionally necessary. There is, therefore, no dust generated at this stage of the process. The leaves are subsequently stripped from the stalks and are put by handfuls into boxes, and in this condition a considerable proportion of the tobacco is sold to dealers. In removing the stalk and center stem of each leaf, and while the leaves are sorted in a drying house, there is no doubt more or less exposure to dust and the pungent odors of the tobacco. When packed into hogsheads, as is always the case for export, there is further exposure, chiefly to the pungent odor of the tobacco, but apparently without serious consequence to health.^(a)

Within recent years tobacco-drying machines, so called, have been introduced extensively, and as a result the preliminary methods of manufacture have undergone material modification.^(b) These so-called "tobacco dryers" are of much the same nature as lumber dry kilns. The temperature of tobacco dryers is stated to be from 180° to 240°, and sometimes very much higher, while in lumber kilns the temperature rarely exceeds 180°. The heat is forced into the dryers by a blower system, often so constructed as to result in dust accumulation, with a consequent risk of dust explosion because of the not inconsiderable quantities of "greasy inflammable dust of tobacco," according to investigations made by fire insurance companies. It has been suggested that the machine used for blowing purposes should have the fan in its journal surrounded by wire gauze of fine mesh so as to intercept the very fine dust, which by inference warrants the conclusion that such dust is present in sufficient quantities to prove a menace to the health of the workmen occasionally employed in drying houses of this construction.

The conditions of labor, as well as the methods of handling the tobacco at this stage, vary widely in the different tobacco districts of the country, and so much so that a descriptive account of the methods in vogue in one section would not be applicable to those in vogue in another section. The manufacturing processes have undergone material changes during the intervening years since the report of the Tenth Census on the tobacco industry was published, but that report still constitutes the most valuable source of information regarding the methods and conditions incidental to the handling of the tobacco

^a For recent accounts of methods of curing tobacco see Farmers' Bulletin No. 60 (1902) and Bureau of Plant Industry Bulletin No. 143 (1909), published by the United States Department of Agriculture.

^b The descriptive account of tobacco dryers is from a report by Mr. Holmes Cummins, special agent of the Firemen's Fund, of Richmond, Va.

preliminary to the manufacturing processes proper. Mention is made in this report, for illustration, of the making of strips in the Evansville and other tobacco districts of Indiana, in which children from 9 to 12 years of age were largely employed, making from 50 to 100 pounds per day, while full-grown experts could make from 150 to 200 pounds. In Virginia, according to the report referred to, the making of strips was a large industry at Lynchburg, the process being described as follows:

Loose tobacco is taken to the factory and placed upon the floor of a room adjoining that in which the work of stemming is done, each lot or pile being kept separate as purchased, or, if want of space makes it necessary, several lots of the same grade, style, and quality are bulked together. The number of pounds of leaf needed to make a hogshead or a tierce of strips of a given grade is carried from the storage-room into the stemming apartment, sprinkled with water to soften, and heated in a steam-box, a few basketfuls at a time. The bundles are then ready for the stemmers, the leaves being supple, pliant, and in such condition that the stems may be quickly removed without tearing the strips.^(a)

It is stated further that stemming at that time was mostly done by negro women, who were very dexterous at the work, and that they were assisted by children, who untied the bundles and placed them ready for the stemmer and straightened and tied up the stems. Children were also employed in putting the bundles of strips upon sticks and in carrying the same to the drying room. The final process of handling the tobacco at this stage of the industry is described as follows:

When the tobacco is thoroughly dry, the windows of the drying room are opened to let it cool off—usually all night. They are then closed again, and soft steam is turned into the room through perforated pipes, so managed as to render the tobacco fit for handling. It is then carefully laid upon the floor in “coops”—one stick with tobacco overlapping another—and built up straight to a height of 5 feet or more, each coop containing one tierce, or two to make one hogshead. Here it remains two days, to cool off and toughen, when it is ready for packing. In the work of packing steam is again used to soften the tobacco, six or eight sticks of bundles at a time being carefully placed within the steam box, the door of which is slightly closed, and soft steam being turned on for one or two minutes. The sticks are then carried to the packing table, opened, the bundles shaken out and straightened, and neatly packed with the least possible delay.^(a)

While during the intervening years there have been some changes, the earlier descriptive account applies with a fair degree of accuracy to the processes of stripping and stemming at the present time. No writer on occupation diseases has given extended consideration to

^a Special report of the Tenth Census on Tobacco Production in the United States, p. 211.

the hygienic aspects of employment in these preliminary operations, although Arlidge observes that the dust generated during the preliminary processes of sorting the leaves is of "no important physiological energy." Nor does he comment unfavorably upon the subsequent processes of stripping the leaves of the midribs, which is usually the work of women and girls.^(a)

In the unpacking of the tobacco from the hogsheads or casks the leaves require to be shaken to remove the sand, dust, and other minute particles adhering to them. The quantity of dust generated in this process differs very materially according to the grade of tobacco handled and its condition at the time of unpacking, but no accurate observations have been made a matter of record as to the actual amount of dust produced and the possible relation of such dust to the health of the workers.

The general hygiene of workers in tobacco has been considered at some length by Dr. Ludwig Jankau, who brings together the results of several investigations made by various governments into the social conditions of persons employed in the manufacture of tobacco, amplified by quotations from medical authorities, which, however, are more or less conflicting. It is made clear that the social condition of labor has an important bearing upon the health of the employees, which may or may not have been exaggerated by the continuous and considerable exposure to tobacco dust, odors, etc. The author quotes the conclusion of Rochs that by proper ventilation of the workroom the employment in tobacco factories is not subject to health-injurious results.^(b) This conclusion is accepted by Jankau, who observes that

^a The conditions affecting health in the process of stripping are discussed by Dr. Roger S. Tracy, in his special report on the tobacco industry, published in the Third Annual Report of the Board of Health of the City of New York, 1873, p. 310; from this report is quoted the following:

Strippers sit upon wooden benches, in a constrained position, all day long. They are not as healthy in appearance as the men, most of them having pallid, flabby countenances, and visiting the dispensaries often to be treated for loss of appetite, chronic bronchitis, and palpitation of the heart. It must be remembered, however, that they have smaller wages than the operatives of the first class, and presumably live much more poorly, besides drinking large quantities of tea, all of which elements in the problem must be fairly considered, before a safe conclusion can be reached regarding them.

Tracy also refers to persons employed in tobacco packing, stating that—

Operatives occupied in packing are generally pretty healthy. They are, however, very subject to nasal catarrh, and catarrh of the larger bronchial tubes, both of which affections are very persistent unless the occupation of the patient is changed. On a seaboard, where catarrh is an almost universal complaint, it would perhaps be unfair to attribute the catarrh of tobacco workers entirely to their occupation.

^b Monograph on Tobacco and Its Effects upon the Human Organism, with Special Reference to its Chemical, Physiological, Pathological, and Therapeutical Aspects, by Dr. Ludwig Jankau, published in the German language, Munich, 1894, p. 16.

if the government regulations as to ventilation are properly complied with the health-injurious results are reduced to a minimum. Since the investigations of Jankau were chiefly for the purpose of determining the possible health-injurious effects of the use of tobacco on the human organism, his limited consideration of the hygiene of the industry itself did not warrant final conclusions. Thus far no qualified inquiry has been made to determine with accuracy how far the preliminary processes in tobacco manufacture are injurious to the health of the workmen employed, but in view of the fact that the period of employment is, as a rule, only for a portion of the year, the health-injurious effects in any event are probably very slight except, perhaps, in the case of children and persons of frail physique, already perhaps, predisposed to diseases of the lungs.

THE MANUFACTURE OF CIGARS AND CIGARETTES.

The tobacco industry in 1905, according to the census of manufactures, gave employment to 159,408 wage-earners, of whom 130,949 were employed in the manufacture of cigars, 4,469 in the manufacture of cigarettes, 23,044 in the manufacture of chewing and smoking tobacco, and 946 in the manufacture of snuff. Of the total number employed, 85.0 per cent were, therefore, engaged in the manufacture of cigars and cigarettes. The distribution of labor according to age and sex varied considerably in the different branches. In the manufacture of cigars and cigarettes, out of a total of 135,418 wage-earners, 57,174, or 42.2 per cent, were women, and 5,274, or 3.9 per cent, were children under 16 years of age. The returns of the census report on occupations for 1900 include all persons of ages 10 years and over employed in the manufacture of tobacco, reported as 131,464, of whom 87,966 were males and 43,498 were females. In considering the health and mortality of tobacco workers it is necessary to keep in mind that an exceptionally large proportion of the workers in this industry are foreign born or of foreign parentage, including a considerable number of Bohemians and Cubans, both nativities being subject to a higher death rate from consumption than the population of native parentage. Of the 131,464 persons employed in the tobacco industry, 40,974, or 31.2 per cent, were native whites of native parents; 34,655, or 26.4 per cent, were native whites of foreign parents; 39,581, or 30.1 per cent, were foreign born; and 16,254, or 12.4 per cent, were colored. In more detail, the numbers employed in the tobacco and cigar industry of foreign parentage were as follows: The number of German parentage was 30,860; of Bohemian parentage, 6,053; of Russian parentage, 6,105; and of Irish parentage, 7,631. The census returns do not state the number of Cubans em-

ployed in the industry, but in cities like Key West and Tampa the large majority of persons employed are of Cuban birth or parentage.

The importance of nativity as a factor in occupation mortality statistics will be better understood when it is stated that, according to the vital statistics of the Twelfth Census, the death rates in the registration area at ages 25 to 34, at which period the mortality from consumption is proportionately of most importance, were 6.4 per 1,000 for persons having native-born mothers, 7.4 per 1,000 for persons having German mothers, 8.1 per 1,000 for persons having Bohemian mothers, and 12.2 per 1,000 for persons having Irish mothers. No official death rates, by divisional periods of life, for the Cuban element of the population have been published. Since the manufacture of cigars in certain cities is very largely carried on by Bohemians, the comparative death rates for selected periods of life are included for the purpose of convenient reference. At ages 15 to 24 the death rate for those having native-born mothers was 5.0 per 1,000 and for those of Bohemian mothers 4.7; at ages 25 to 34 the rates were 6.4 per 1,000 for those of native-born mothers against 8.1 for those of Bohemian mothers; at ages 35 to 44 the respective rates were 7.5 per 1,000 against 10.5; at ages 45 to 64 they were 14.6 against 18.8; and finally, at ages 65 and over the rates were 65.9 per 1,000 for persons having native mothers against 72.7 for those having Bohemian mothers.^(a)

It is evident that important differences like these require to be taken into account, but it has not been clearly established whether the Bohemians, as such, are subject to a higher death rate, or whether the excess in the Bohemian mortality in the United States is the result of an unfavorable environment and employment in health-injurious occupations.

In the manufacture of cigars, according to the factory census of 1905, 130,949 wage-earners were employed, and of this number 54,426, or 41.6 per cent, were women. In the manufacture of cigarettes 4,469 wage-earners were employed, and of this number 2,748, or 61.5 per cent, were women.

From a descriptive account of the tobacco industry as carried on at the present time, included in the census of 1900, is quoted the following:

Within the last few years both the cigar and the cigarette manufacture have been revolutionized by machinery. As cigar making is widely diffused in the form of numerous small establishments in which the work is done by hand, the utilization of modern machinery in the manufacture of cigars is not as general as in that of cigarettes, which is concentrated in large factories. Four cities, namely, New York, N. Y.; Richmond, Va.; Durham, N. C.; and Rochester, N. Y.,

^a Report on Vital Statistics, Part I, Twelfth Census of the United States, 1900, p. lxxxiv.

produce about 94 per cent of all the cigarettes manufactured in the United States, and practically all are machine made. Considering the large number of very small cigar factories in the United States, comparatively few establishments of this class are sufficiently large to make a complete equipment of modern machinery a paying investment. Taking the largest factories, however, as representative of the application of modern machinery to the industry, it is a fact that both cigar and cigarette manufacturers are utilizing some of the greatest contributions of genius to the lessening of the world's work. Everything, from the stemming of the leaf to the payment of wages to the employees of the factory, is done by machinery. In a modern cigarette factory the prepared tobacco and the sheets of paper used for wrappings are fed to machines which cut the paper into proper size for the wrapper, gum its edge, measure the exact quantity of tobacco needed for each cigarette, wrap it, make the edges of the wrapper adhere, cut the ends, and pack the cigarettes in boxes. In the manufacture of cigars, the prepared filler is placed in the hopper of a machine which apportions the quantity necessary for each cigar, places it in the binder spread to receive it by the operator of the machine, and rolls it. The wrapper is subsequently added by hand or by machinery.

The crude hand manufacture of chewing and smoking tobacco and snuff from the natural and unflavored leaf has grown to the modern manufacture of a multitude of forms, which are the products of elaborate systems of selections, blending, fermentation, flavoring, and saucing, designed to satisfy the tastes of the various classes of consumers. As to form, there are two general classes of smoking tobacco put upon the market, namely, the granulated or flake, and the cut or shredded forms. The former is produced by granulating machines of different styles and varying capacity, in which the breaking and sifting principles predominate. The latter class is produced by feeding the prepared tobacco, flavored and gummed, into machines which first compress it and, in turn, feed it to rotating or vertically reciprocating knives, which shred it to any desired fineness; it is then dried and "bulked," after which it is packed in paper, foil, cloth, tin, or glass packages in a multitude of sizes and styles.^(a)

It is evident from the foregoing descriptive account that the processes of manufacture involve more or less the production of considerable quantities of tobacco dust. In the making of fine-cut chewing tobacco practically the same machinery is employed as in the manufacture of smoking tobacco, but the leaf is cut into much finer shreds, which in all probability is the cause of a larger amount of dust production.

The division of labor in cigar making is briefly described in a special report of the Commissioner of Labor, on the restriction of output, with special reference to the tobacco industry, in part as follows:

In cigar-making establishments where there is a division of labor, the employees are usually divided into the following classes: Casers,

^a Report on Manufactures, Part III, Twelfth Census of the United States, 1900, pp. 671, 672.

who dampen the tobacco; strippers, who remove the large midrib of each leaf (removing all the rib from Sumatra wrappers and from seed, that is, domestic tobacco, and two-thirds of the rib from Habana tobacco); bookers, who straighten out the leaves, making them up in pads for bunches and wrappers; bunch makers (also called filler breakers), who shape the filler tobacco, covering it with a portion of a leaf large enough to make a binder, which holds it in shape; rollers, who cut the wrappers and roll them around the bunches, and cut off the tuck or open ends, completing the cigars; packers, who assort the cigars according to color, pack them in boxes, and paste the internal-revenue stamp thereon.^(a)

In the same report it is stated that in a large factory having a total of 1,639 employees the number employed in the different occupations were classified approximately as follows: "Casers, 40; strippers, 160; bookers, 60; cigar makers, who do both bunch making and rolling by hand, 360; bunch makers, 290 (55 making bunches by hand, 235 by machines); rollers (by machine), 465; packers, 110; foremen, 16; floor boys and miscellaneous help, 138."^(a)

Among other factors which require to be taken into account is that cigars made in open or nonunion shops are usually made with machinery, while those made in union shops are almost invariably made by hand. The hours of labor vary, averaging not quite 53 in nonunion factories to a trifle over 45 hours a week in union factories. In making cigars entirely by hand the tools employed are a table, a knife for cutting wrappers to shape, and a cutter which clips off the tuck ends of the cigars. The last-named instrument is of considerable hygienic importance in that it does away with the insanitary habit of biting off the ends, which are often swallowed by the operatives, with unmistakable injurious consequences to health. Machines are used to an increasing extent, and particularly so in the manufacture of cigarettes, in which they almost entirely do away with the necessity for hand labor. In factories where machinery is most used, "there are machines for stripping and booking the tobacco, machines for chopping up tobacco for short-filler bunches, machines for making short-filler bunches, machines for making long-filler bunches, and machines for rolling cigars."^(b)

From the same report is quoted the following descriptive account of other important machinery used in the manufacture of cigars at the present time:

The cigar-rolling machine, or suction table as it is called, is also a hand machine, except that power is needed to operate the exhaust fan which supplies necessary suction. On this table the operator,

^a Eleventh Special Report of the Commissioner of Labor, Regulation and Restriction of Output, p. 559.

^b Idem, p. 572.

by means of a die, cuts out the wrappers and then rolls them around the bunches, while the leaf is held down flat by suction.

Another machine is called the dieless suction table, the perforations for suction being in a flat plate instead of in a die. One advantage of the suction table, from the manufacturer's standpoint, is that it aids in stretching the wrappers more than can be done by the fingers alone, hence an additional wrapper can frequently be obtained from the leaf.

The long-filler bunching machine and the suction table are in use in large factories throughout the United States and Europe.^(a)

How far the use of machinery bears upon the question of health has not been determined, but it is safe to assume from such accounts as have been published that the conditions affecting health have been somewhat improved. The use of machinery in cigar making is on the increase, and it is estimated in the report previously referred to that 85 per cent or more of the cigars manufactured in the United States are retailed at 5 cents or less, and that within the next ten or fifteen years all of this class of cigars will be made by machinery. It is pointed out in the same report (p. 575) that "the use of machinery tends toward an increase in the size of the establishment, and it is significant that in each of the three cities [investigated] the open and nonunion factories using machinery are very much larger than the union factories." The principal objection of labor unions against the use of machinery is stated to arise from the fact that a much cheaper grade of labor may be employed, and that while formerly only men were engaged in cigar making, since the introduction of machinery the proportion of female employees has become very large; in fact, it is stated that in many factories only women and girls are employed on the bunch-making machines and suction tables, and that the number of females is as high as 80 per cent of the total number of employees, including the miscellaneous help. In the 7 open and 2 nonunion factories investigated, with a total of 4,169 employees, the number of females was 3,049, or 73.1 per cent, against 36.1 per cent of females employed in 8 union factories. While apparently these considerations have not a direct relation to the hygiene of the industry they are nevertheless important and more or less determining factors which require to be taken into account.^(b)

The hygienic aspects of the tobacco industry, chiefly with reference to the manufacture of cigars and cigarettes, have been considered by practically all the authorities on the diseases of trades, beginning with Ramazzini in 1670. Even at that early date the use of tobacco had

^a Eleventh Special Report of the Commissioner of Labor, Regulation and Restriction of Output, pp. 572, 573.

^b For a descriptive account of cigar making by machinery, with many illustrations, see the *Scientific American* for July 7, 1906.

become quite general and the health-injurious effects in individual cases of excess in the use of tobacco had become apparent. At that time the use of snuff was much more common, however, than the use of tobacco in the form of cigars and for smoking and chewing purposes, and Ramazzini observes that the use of snuff had in his time become so common in Italy that men, women, and children made use of it, and that it was included in the daily provisions of a family. He remarks that "the tobacconists themselves who prepare it are sufficient evidence of its unjuriousness to the head and stomach," and that the workmen employed in its manufacture suffered from headache, migraines, and other afflictions, until inured to the employment by continuous exposure.^(a) The observations of Ramazzini are, however, chiefly with reference to the health-injurious consequences of excess in the use of tobacco, and not so much with the health of the workmen employed in its manufacture. Among other remarks by Ramazzini which may be included here, is a reference to the use of chewing tobacco, regarding which he remarks that "I have known a great many brought to consumption by chewing tobacco who flattered themselves that their health was preserved by the continuous flux that issued from their mouth and could hardly be persuaded that they did themselves an injury in thus robbing the saliva glands, etc., indeed, the whole body, of their nutritious juice."^(b) More scientific investigations of recent times fully sustain the early opinion that there is quite probably a very intimate relation between the use, and certainly the excessive use, of tobacco and disturbances of and interference with the nutritive functions.

After Ramazzini the subject was considered by Thackrah, who remarks that—

Tobacco manufacturers are exposed to a strong narcotic odor, and in the stoving department to an increase of temperature. Yet the men appear healthy. Here, as well as in several other employments, we admire the agency of that conservative principle, to which I lately referred. Men breathe an atmosphere strongly impregnated with a poisonous substance, yet become insensible to its influence. The only ill effect we can find is from the heat of the stoving department, which all men can not bear.^(c)

Also, Thackrah quotes from the *Lancet* an interesting account of the observations by M. Pointe, of Lyon, France, relative to tobacco manufacture in that city, in part as follows:

The number of workmen who were the subject of M. Pointe's observations amounted to 500; they were employed at one manufac-

^a Treatise of the Diseases of Tradesmen, Ramazzini, English edition of 1705, p. 90.

^b *Idem*, p. 93.

^c Effects of Arts, Trades, and Professions on Health and Longevity, by C. Turner Thackrah, 1832, p. 56.

tory, and, although occupied in different ways, were all of them in continual contact with tobacco. The affections to which they seemed subject were principally pulmonary consumption, inflammation of the eyes, anthrax and furuncles, the two latter of which generally appeared on the trunk, were extremely tedious, and unless the occupation of the patient was changed, hardly ever admitted of permanent cure; but the affection which seemed to prevail most was purpura hæmorrhagica, and a disposition to scurvy. On the other hand, it is worthy of remark that tobacco manufactories, in some degree, appear to be exempt from certain affections, viz, intermittents and scrofula, which are very common among the inhabitants of Lyon, the latter being remarkably prevalent in other manufactories, especially those of silk. Itch, against which tobacco has often been asserted to possess prophylactic powers, was very frequent; but trembling and nervous affections, to which persons who are much in contact with narcotics are said to be very liable, was in no instance observed as the effect of continued employment in the manufactory in question.^(a)

Halfort, in 1845, refers to the investigations by Simeon, pertaining chiefly to the French snuff factories and including about 5,000 workmen, confirming the favorable conclusions of Thackrah, that the dust produced in tobacco manufacture did not, apparently, have a decidedly injurious effect upon health. Halfort adds the statement that it has been observed that tobacco workers were less liable to infectious diseases than workmen in general, but he did not support his conclusions, nor those of earlier writers, by conclusive statistical data of sickness and mortality.

More scientific and conclusive are the observations of Dr. Waller Lewis in 1855 on "The diseases of workmen employed in the manufacture of tobacco." After stating that there were then ten large government factories for the manufacture of tobacco in all its branches, and after pointing out that the health conditions would necessarily vary in the different establishments, Lewis remarks:

Medical men are attached to these factories; their institution goes back to the earliest times of the monopoly, that is to say, 1811. For a long time their duties consisted merely in visiting the workmen, either at their entrance into the works, in order to certify as to their health, and to put aside those in ill health and those laboring under contagious diseases, or during their sojourn in the factories, to give them advice and attention. At the present time the mission of these physicians is more extended. The administration has increased it by requiring them to transmit, in detailed reports, annually, the remarks which they may have made upon the health of the workmen, upon the maladies observed in the manufactories, and on the peculiarities which these maladies may have presented; a most excellent measure, which bears witness to the zeal of the administration for

^a Effects of Arts, Trades, and Professions on Health and Longevity, by C. Turner Thackrah, 1832, p. 56.

the interests confided to it, and which should be adopted in all establishments which occupy a number of workmen.^(a)

The consensus of medical opinion at that time is summed up in the statement by Lewis, that "tobacco appears but rarely to produce sensible effects on the workmen, even at the commencement of their work." In the manufacture of snuff, however, more injurious effects had been observed, and in some cases permanent injury had been produced in the case of persons of a very nervous temperament. Some of the medical attendants assert that the manufacture of tobacco is not only not injurious to the men, but that it even prevented phthisis and other diseases of the chest. Lewis quotes a Doctor Melier, who had lately investigated the subject, to the effect that new workmen had always some difficulty in accustoming themselves to the atmosphere of the workshop, "charged as it is with particles of the tobacco." After, however, the first difficulties are surmounted, the workmen become habituated to the work and indifferent to their surroundings. In conclusion, however, Lewis makes the significant admission that—

Certain workmen, however, experience a considerable change, which deserves attentive study. It consists in a particular alteration of the complexion. It is not a simple discoloration, an ordinary paleness, it is a gray aspect, with a wan dull appearance, a mixed shade between chlorosis and certain cachetic diseases. The physiognomy receives from it a peculiar character, which an eye accustomed to see these cases can recognize immediately as occurring only to tobacco workmen. This facies is only observed among those that have been long at work at tobacco. Doctor Hurteaux states that it requires at least two years to acquire this countenance.^(b)

In suggesting remedies to overcome the injurious effects likely to result in the different branches of tobacco manufacture, Lewis suggests a mode of fabrication "which causes the least disengagement of dust," which in itself is a candid admission of a considerable quantity of dust produced, in any event, in the manufacture of snuff. He further suggests improved methods of ventilation, and finally, that individuals of weak or nervous constitution should not be employed in tobacco factories. The reduction of dust, in his opinion, would be secured by handling tobacco in a moist state, for it had been observed that the health of the workmen was much more affected when the tobacco was handled in a dry state.

While the observations by Lewis and others of that period are favorable to the industry, they are not conclusive, in the absence of the necessary comparative statistical data, exhibiting precisely the

^a Report on the Laws and Ordonnances in Force in France for the Regulation of Noxious Trades and Occupations, London, 1855, pp. 67, 68.

^b Idem, p. 69.

incidence of diseases more or less resulting from continuous exposure to the emanations or odors of tobacco on the one hand, and of considerable quantities of dust on the other. The favorable conclusions of Lewis are partly contradicted by his own suggestion for improved methods of ventilation and dust removal, for, if he had not thought the dust injurious or detrimental to health, it would certainly not have attracted his attention.

Hirt, in 1871, contributed the first extended consideration to the subject of tobacco workers and their diseases, preceding his remarks by a bibliography, limited entirely to French and German sources. He observes at the outset that probably no other question has aroused more controversy in the discussion of occupation diseases than the effects of tobacco, and in particular tobacco dust, upon human health. Regardless of the many investigations which had been made up to that time, Hirt observed that no definite conclusions had been reached. He called attention to the remarkable contrast in the conclusions arrived at by different authorities, some declaring that the industry was free from objectionable features, others maintaining, on the contrary, that the employment was decidedly injurious to health. Hirt calls attention to the paucity of statistical data regarding the health of persons employed in the tobacco industry, and not even the government tobacco factory of Paris, with more than 5,000 employees, was in a position to furnish a statistical statement of the health and mortality of the employees. In considering the various branches of the industry, Hirt described in some detail the preliminary processes, chiefly in connection with the manufacture of smoking tobacco, but he, apparently, considered these branches free from conditions injurious to health. He remarks that tobacco dust is produced in the sorting and cutting of tobacco, in the manufacture of cigars, but only in very considerable quantities in the manufacture of snuff. But, apparently, much more important as a factor detrimental to health, is the odor of the tobacco itself, or the evaporations, on account of the presence of perceptible proportions of nicotine. In the opinion of Hirt, it can not be questioned that these effects are equally, if not more, serious in their consequences than exposure to tobacco dust, for he points out that the consequences of exposure to tobacco odors are disturbances of the nervous system and the serious impairment of the digestive functions, including effects on the metabolism generally, made evident in alterations of the red corpuscles of the blood. These effects, of course, do not require extended consideration in a discussion on the effects of dust on the health of workmen and the relation of such dust to the degree of consumption frequency, but they require to be considered as contributory causes, tending materially to increase the liability to tubercular diseases. Among these

contributory causes Hirt mentions also the comparatively high degree of temperature, tending to increase the health-injurious effects of nicotine in the atmosphere, the importance of which perhaps is made more clear when it is stated that in American leaf tobaccos which have been analyzed the proportion of nicotine varies, according to Dr. Gideon E. Moore, of New York, from 0.63 per cent to 5.60 per cent.

While Hirt concedes the dusty nature of the employment, he leaves the question open as to whether the effects of such dust are really injurious to the workmen. His own conclusions are rather favorable, but they are not fully sustained by the necessary statistical evidence. He concedes that there is a division of medical opinion and that many physicians who have practised for years among the employees of tobacco factories consider the dust as decidedly injurious and dangerous to health. Hirt himself emphasizes the great importance of adequate ventilation to reduce the dust nuisance to a minimum, while at the same time he calls attention to the importance of regular habits of life and sobriety as the best safeguard against ill health and premature mortality. He remarks that at that time at least, referring to conditions in Germany, the social condition of labor among tobacco workers was of a decidedly low order, which in itself would account for a considerable proportion of the mortality from phthisis without necessarily any reference to the exposure to tobacco dust. As to the occurrence of tabacosis pulmonum, Hirt is of the opinion that a distinct occupation disease resulting from the inhalation of tobacco dust has not been clearly established, and that before a conclusive opinion could be rendered upon this subject much more satisfactory pathological evidence would be required.

That the liability of tobacco workers to the inhalation of health-injurious dust is not exaggerated even by Hirt is made evident by a brief reference to the subject in Doctor Mapother's lectures on artisans' diseases before the Royal Dublin Society in 1874, where the opinion is expressed that—

As regards the tobacco trade, cleanliness, ventilation, and the use of a respirator, would greatly lessen the weakness, functional heart diseases, and extraordinary complexions, which greatly trouble the workers. Their time of work should be short, with frequent intermissions. Rolland's torrefier is used in France, to the great advantage of the work people.

Dr. B. W. Richardson, in 1876, considered the health-injurious effects of tobacco dust, observing that—

The dusts arising from tobacco-leaf during the process of making cigars is most injurious. While the leaf is being rolled up, unless the ventilation of the room is exceedingly perfect, the dust from broken leaves and siftings is inhaled, and proves most irritating. In

the course of drying, the dust and vapor from the drying room act in combination, and lead not only to oppression of breathing, but to dryness of the throat, and, in the young, to giddiness and nausea. One workman told me that he never got over the bronchial irritation produced by this dust until he left his work at night; then the effect subsided.^(a)

Writing with special reference to American conditions, Tracy, in a discussion of the diseases of occupation, states that—

Persons who are engaged in the manufacture of tobacco inhale dust which contains nicotine and some ammonia. It is not necessary here to describe the various processes of curing, sorting, stripping, cutting, and drying the leaf, or to go into the particulars of the manufacture of cigars and snuff. There is in all the rooms of a tobacco factory a strong odor of tobacco, caused chiefly by dust, and in the rooms where snuff is packed the atmosphere is fairly thick with it. The workmen are, therefore, all subjected in different degrees to the action of the tobacco dust as an external irritant, and also to the absorption of nicotine by the system.^(b)

Referring to the conflict of opinion among authorities on diseases of occupation regarding the more or less health-injurious consequences on persons employed in the manufacture of tobacco, Tracy remarks that—

While Ramazzini, in accordance with his usual pessimistic tendencies, declares that all the workmen are in general thin, pallid, yellow, and asthmatic, and suffer violent pains in the head, vertigo, nausea, and continual sneezing, and Heurtaux, Kostial, and others have agreed with him more or less, Parent-Duchâtelet, d'Arcet, Ygonin, Berutti, and Chevallier claim that workmen in tobacco factories are as healthy and long-lived as any other artisans, or even more so. The truth, as is apt to be the case in disputed questions, probably lies between these two extremes.^(b)

Tracy also considered at some length the effects of work in tobacco factories on the health of young women, sustaining by statistical data of the average fecundity among women cigar makers and among the general population his conclusions adverse to the employment of females in such establishments. Curiously enough, Tracy concludes that no special preventive measures are necessary in tobacco factories, except to forbid the employment of children under puberty, and possibly all females, disregarding entirely the abundant evidence of dust-generating processes more or less injurious to health.^(c)

^a Lecture on "Unhealthy trades," by Dr. B. W. Richardson, *Scientific American Supplement*, March 4, 1876, p. 154.

^b *Hygiene and Public Health*, edited by A. H. Buck, M. D., Vol. II, 1879, p. 41.

^c The conclusions of Tracy were based upon special investigations made as assistant health inspector to the city sanitary inspector of the health department of the city of New York, published in the form of an appendix to the Third Annual Report, 1873, pp. 308 et seq.

The New Jersey bureau of labor statistics, in 1892, made an investigation into the trade life of cigar makers, including 1,061 persons, of whom 33.2 per cent had entered the trade life at ages under 16 years. By ages attained, 3.4 per cent were between 51 and 60 years, and only 1.1 per cent were 61 years of age and over. According to the country of birth, 34.2 per cent were foreign born. Of the total number under observation, 9.8 per cent were beginning to decline, the proportions varying, of course, with increasing age, ranging from 1 per cent at ages under 26 to 21.2 per cent at ages 41 to 50, and 58.3 per cent at ages 61 and over. The average number of years at work was returned as 14.4, varying also, of course, with increasing age, or from 5.2 years at age 21 to 20.1 years at ages 36 to 40, and 48.3 years at ages 61 and over. Arranged according to the number of years at work, 10.3 per cent had been employed under 5 years, 25.6 per cent from 5 to 9 years, 23.2 per cent from 10 to 14 years, 16.7 per cent from 15 to 19 years, 15.8 per cent from 20 to 29 years, 6.3 per cent from 30 to 39 years, and 2.1 per cent had been at work for 40 years and over. Of the number returning their health as in a period of decline, 35.6 per cent gave the cause as diseases of the throat and lungs, 33.6 per cent as general debility, 8.6 per cent as failing eyesight, 5.8 per cent as rheumatism, 5.8 per cent as catarrh, and 4.8 per cent as nervousness. While the results of the investigation do not warrant final conclusions as to the relation of the industry to health, the data are sufficiently convincing to prove that the normal duration of trade life is curtailed in the case of cigar makers as the result of the employment.

Arlidge, in his account of the hygiene of tobacco manufacture, first calls attention to the conflicting opinions respecting the health phenomena attending the occupation, observing, however, that those attributing to it serious results were chiefly found in the older writers, though some more recent ones had given them their sanction. He remarks that—

The processes of tobacco making are not numerous nor complicated, but they vary according to the particular product required, whether cigars, smoking tobacco, or snuff. The first business is to sort the leaves, and is attended by the emanation of dust of no important physiological energy. The next is to soften them by damping with water; and when this—a harmless proceeding—is effected, the leaves pass into the hands of women and girls, who strip away the midribs. They are then ready for making into cigars by simple handiwork. But if tobacco for smoking be wanted, the leaves are cut up by machines, and afterwards subjected to a high temperature in shallow-heated pans, whereby the fumes of the plant are largely driven off; and, unless ventilation be very efficient, they will exert more or less pernicious influence upon the men engaged in the opera-

tion. The only remaining stage is the cooling of the tobacco by spreading it out in trays disposed on frames in the cooling-room.^(a)

Arlidge refers to the article on the hygiene of tobacco manufacture contributed to the New York Medical Journal by Dr. E. T. Ely, in 1880, who speaks of the production of cough, pharyngeal catarrh, dyspepsia, and nervousness as incidental results of the employment. In the opinion of Arlidge, however, it must be taken into account that of the 102 tobacco workers examined by Ely, all were incessantly smoking, and carried on their labor in close, insanitary rooms, working long hours, and on the principle of piecework. Doctor Ely's conclusion was to the effect that, unless there existed a peculiar susceptibility, employment in tobacco making was as healthy as other occupations of a like sedentary character. In considering, however, the effects of the industry it is necessary to take into account the different occupations followed, and, in the opinion of Arlidge, the most prejudicial operations are those of drying the tobacco, of clearing the fermenting chambers, and of unloading the cases of snuff after its second fermentation. It is evident that Arlidge did not personally inquire to any very considerable extent into the different branches of the industry, but that his conclusions apply to the employment as a whole. He remarks that it is very difficult to reconcile the conflicting views respecting the maladies of workers in tobacco, and his own limited personal knowledge of the industry, in his own words, did not enable him to substantiate the serious conclusions of some of the writers on the subject. Arlidge did not sustain his observations or conclusions by statistical data, but it is evident that he agreed with those who were inclined to consider the industry as comparatively free from conditions and circumstances injurious to the health of the employees.

In 1895 a contributor to the Twentieth Century Practice of Medicine (Vol. III), in a monograph on the diseases of occupations, called attention to the wide difference of opinion on the subject of the evil effects of the manufacture of tobacco. This writer emphasized the importance of a proper consideration of the conditions under which the work is carried on and the wide difference in mortality resulting from variations in races, countries, and, above all, in hygienic and trade conditions. He further emphasized the fact that tobacco workers the world over do not live and work under identical conditions, and that into the question of their health and the influence of their occupation enter also considerations of personal and social hygiene. Occupation, in brief, is only one factor, and often only a

^a Diseases of Occupations, by J. T. Arlidge, p. 390.

minor one as the causation of disease in artisans. He stated further that—

The manner of absorption of the tobacco poison in the manufacture may be, presumably, by inhalation of dust and vapor, and by direct contact and absorption through the skin. The dust and vapor of the workshops are charged with the peculiar odor. Absorption by the skin is certainly possible. The physiological effects of tobacco can readily be obtained by the application of tobacco juice or of a strong decoction of the weed to the skin. I have seen a small dog made very ill by a tobacco-wash, used for killing fleas. It seems that workmen and workwomen, however, come in contact with tobacco only with the skin of the fingers and hands, and the absorbing power of the skin in these places is slight. There is no satisfactory evidence that work-people suffer in this way. Moreover, many of the work people use tobacco to excess, especially in the form of chewing or snuff, and the amount that they might absorb must be vastly in excess of what they could take in either by inhalation of vapors and dust or by contact with the hands.^(a)

After summing up the widely conflicting views of the authorities on the subject, Doctor Lloyd himself did not arrive at more definite conclusions.

A more qualified and scientific inquiry into the subject was published in 1897, in Weyl's Handbook of Hygiene, in the form of a monograph on the hygienic conditions of the tobacco industry, by E. Schellenberg, grand ducal factory inspector for Baden. Schellenberg at the outset of his discussion calls attention to the higher degree of consumption frequency among tobacco workers in Baden compared with the general population. He refers to a statistical investigation made in two factory-inspection districts, based upon the observed excess in the mortality from consumption among cigar workers in particular localities. Whether the excess in the mortality from consumption was the result of the industry itself, or because of the fact that the industry attracted the weak and otherwise predisposed to consumption, was not clearly brought out by the official investigation. Schellenberg, however, states that from a social and economic point of view tobacco workers were at a decided disadvantage, and that their poverty and long hours of labor were more probably the causes responsible for the excess in the mortality from consumption than the conditions in the industry itself. He, however, concedes that tobacco dust is, in itself, a factor seriously detrimental to health; at the same time relatively large quantities of nicotine enter the system both through the dust and the insanitary habit of swallowing small particles of tobacco, which, being done persistently, amounts to a considerable quantity, with more or less serious results. Schellen-

^a Monograph by Dr. James Hendrie Lloyd, Twentieth Century Practice of Medicine, Vol. III, pp. 431, 432.

berg finally contrasts the sanitary condition of large and modern factories with the more primitive and crude structures and conditions, warranting the conclusion that as a result of sanitary improvement a very material change for the better is possible in the conditions affecting the health and life of persons employed in the industry. As a most important sanitary improvement, he suggests effective methods of tobacco dust removal and adequate provision for light, air, and sanitary facilities.

While the foregoing observations refer to the German cigar industry, they are equally applicable to American conditions. Of special importance in this connection are the official regulations governing the installation and operation of tobacco factories, which went into force for the German Empire under date of July 8, 1893, and which are printed in full in the treatise on industrial diseases by Sommerfeld.^(a)

The most recent authority on the diseases of persons employed in tobacco and cigar manufacture is Dr. Thomas Oliver, who, in his treatise on Dangerous Trades, published in 1902, remarks that—

In the manufacture of tobacco for smoking it is generally conceded that during the chopping up of the leaves and their subsequent exposure to a high temperature in shallow vessels certain fumes are given off that are obnoxious to the workmen engaged in this operation, also that during the grinding of snuff irritating gases and dust are evolved. Apart from these, however, the industry is on the whole a healthy one. Some people have an idiosyncrasy which causes them to be easily affected by tobacco. New hands on entering a tobacco factory for the first time often experience a good deal of nausea, headache, and giddiness, and they sometimes too have a sense of faintness, but by degrees they become accustomed to the odors. At the Newcastle Dispensary I am occasionally consulted by female tobacco-spinners on account of persistent headache, nausea, dislike to food, anæmia, and muscular feebleness. I have never observed the transient loss of sight nor the pharyngeal catarrh alluded to by some writers. Melier held the opinion that working in tobacco arrested tuberculous disease, but this is simply an opinion, and is uncorroborated by the experience of others. Poisson and Eulenburg take the opposite view, and maintain that tuberculosis is a very frequent disease indeed in tobacco workers, especially in females. In the lungs of tobacco-workers, both at home and abroad, there have been found pigmentation and patches of brown induration. Similar lesions have been observed in the lungs of animals experimentally exposed to tobacco dust; but at best these changes in the human subject must be regarded as of extremely rare occurrence, and are more than likely due to the inhalation of vegetable and mineral dusts which dry tobacco often contains. Given a healthy man or woman, and a well-ventilated factory provided with the proper means for removing dust

^a Handbuch der Gewerbekrankheiten, by Dr. Th. Sommerfeld, Vol. I, Berlin, 1898, p. 129.

and foul air, there is nothing in the manufacture of tobacco or in the making of cigars to cause the occupation to be regarded as one very prejudicial to health.^(a)

Oliver extended his studies to continental tobacco factories, including some of those in Spain, but his conclusions regarding the comparatively harmless character of tobacco dust remained unchanged. Oliver did not include in his consideration an extended analysis of the statistical data of the employment, which data, as will presently be seen, show a high mortality rate from consumption among workers in tobacco. From Ramazzini to Oliver the number of those who have written upon tobacco in its relation to health is very large, but the opinions vary so widely that while many of those who have written on the subject have made contributions of interest and value from a medical point of view, it is still an open question whether the employment as such really is or is not injurious to health, with special reference to conditions predisposing to a high mortality from tuberculosis.

A lady factory inspector, in the Annual Report of the Chief Inspector of Factories and Workshops for 1904, calls attention to the conclusions of Doctor Oliver, restated in the sentence that, "Given a healthy man or woman and a well-ventilated factory provided with the proper means for removing dust and foul air, there is nothing in the manufacture of tobacco or in the making of cigars to cause the occupation to be regarded as one very prejudicial to health." She observes further that—

This is a guarded statement to which I think all would assent, but the chief requirement, "a well-ventilated factory provided with the proper means of removing dust and foul air," is seldom, in my experience, found in cigar factories. Directly the cold weather commences the windows are all closed, and if they do not fit tightly the cracks and crevices are stopped up with paper and rags, as cigar making being a preeminently sedentary occupation (with less movement or change of posture than in perhaps any other) the workers are very sensitive to draft. The plan of many of the rooms, open staircases leading into them from rooms below, or partition walls having been removed and the whole floor thrown into one, makes them particularly difficult to ventilate by ordinary methods. I should suggest a fan as being the best means of ventilation for cigar-making rooms were it not that in most of these factories a fan would cause intolerable drafts unless some considerable structural alterations were carried out to protect the workers. Without the intelligent cooperation of the employers it would be impossible to ventilate these rooms and not at the same time cause discomfort and even injury to the workers.^(b)

^a Dangerous Trades, by Thomas Oliver, 1902, pp. 793, 794.

^b Report of the Chief Inspector of Factories and Workshops for 1904, p. 264.

While the foregoing account may state conditions somewhat dissimilar to those existing generally in the United States, it is safe to assume that in exceptional cases at least the sanitary conditions of small cigar factories in this country are not better than the corresponding conditions observed and reported upon abroad.

In recognition, however, of the unsatisfactory conditions reported upon from time to time by inspectors of the factory-inspection service, a special inquiry was made by two lady inspectors in 1906, which included a careful consideration of every branch of the industry and which is of particular interest in that it includes observations upon the hygiene of preliminary processes and the relation of the same to the health of persons employed therein. From this report are made the following brief extracts. The suggestions for practical remedial measures are more or less applicable to the solution of similar problems of tobacco-factory hygiene in the United States:

Steaming processes are undoubtedly the roughest, the most disagreeable work, and the most likely to affect the health of the workers. The actual opening and stripping are generally speaking done in good rooms, and there is nothing objectionable in this work for women. It is in the steaming, and more especially where stripping is done in conjunction with steaming (the leaf being stripped while the steam is actually rising from it), that the most objectionable features are found. There are several different methods of steaming; the old-fashioned method is to lay the leaf on a trough (into which steam is turned) placed under a hood with a shaft for steam to escape, or preferably a fan. Another method is to feed the leaf into a huge revolving cylinder, through which the steam is poured, and the steaming leaf drops out at the other end. In one case we found that the steam which rises in great volume at the exit was successfully carried off by means of a specially constructed shaft and fan, in accordance with the suggestion of H. M. inspector, Miss Paterson. Another method, probably the most modern, is to feed onto a traveling sheet which passes through an inclosed steam chamber; where an exhaust fan is connected with this, and the machine is well made and carefully arranged, the result is good.

After the tobacco has been cut or shredded, some of it is stoved, and so far as we know no women are employed on this process. The tobacco is laid on heated trays to reduce the amount of moisture; men are continually bending over these trays to toss and shake the tobacco about, and although a good deal of steam rises, we have found special means (other than roof ventilation) adopted for collecting and carrying off. The difficulty appears to be that the men must have ready access to the whole tray to constantly move about the tobacco, and for this purpose they are placed out in the middle of the room.

This is invariably done by men, and is a very dusty process. A great deal of it seems to us unnecessary, as except where ground for commercial snuff, it is only ground for offal. In some cases we found special means of exhaust ventilation, in others no attempt was made to reduce the dust, which was in one case emptied on the floor after

being ground and shoveled with spades into sacks, causing clouds of irritating dust to rise. The men in this room did not look healthy.^(a)

In connection with cigar making, it is stated that—

Small pieces of leaf drop to the floors, which are frequently swept during the day by little girls employed solely for this purpose and to wait on the cigar makers. A fine brown dust arises and settles on walls, lamps, and tables. The class of women employed in cigar making is superior to those engaged in stripping and opening.^(a)

With reference to ventilation, the report states that—

By far the worst ventilated rooms we have found have been those in which cigar making is carried on; they are frequently very high, and when filled to the full extent permissible, the floor space is much overcrowded. Ventilation is by means of windows only—generally found closed. The work is very sedentary, and the draft from an open window falling on the workers is often intolerable. A great deal of gas is burned for lighting purposes, and a heavy atmosphere hangs over the heads of the workers, and is specially bad in the afternoons. In many of these cigar factories there is no power with which to drive a ventilation fan, although we think that the time has come when a small motor or gas engine for this purpose should be required. We found that the ventilation was also unsatisfactory wherever factories or workrooms were built on the gallery system, a method of architecture singularly undesirable for factories. The whole question of ventilation seems to have received less attention than might have been expected; the workers have in this respect been left much to their own devices, with the result that little use is made of the means provided, and all fresh air is carefully excluded.^(b)

With a due regard to the conditions affecting health as ascertained by careful inquiry through trained inspectors, the final conclusion is a remarkable one, it being stated that “it is impossible to consider the industry an unhealthy one,” and, further, that—

With the exception of one or two processes, there has been little or no evidence to prove that the manufacture of tobacco is in itself injurious to health. We inquired carefully from doctors, managers, foremen, and the workers themselves, and we have only heard of 2 cases of nicotine poisoning, 2 cases of amblyopia, 1 case of smoker's heart, and 1 case of gastralgia, in the whole course of our inquiry, and some of these cases occurred two or three years ago. On the other hand there is distinct evidence of a considerable amount of discomfort and nausea when workers are first exposed to the fumes; in most cases this quickly passes without any permanent ill effect, but in some instances where there is a special idiosyncrasy, the worker is obliged to seek other work.^(b)

The foregoing statement is the result of personal observation and inquiry, rather than of statistical data of health and mortality. The fact may possibly have been overlooked that a considerable proportion

^a Report of the Chief Inspector of Factories and Workshops for 1906, pp. 250, 251.

^b *Idem*, pp. 252, 253.

of men and women may be only temporarily, or for a short period of years, employed in one branch or another of the industry, and that removals from one locality to another may also interfere with inquiries made for the purpose of ascertaining the true and ultimate effect of the employment on health. The only particular occupation which it is admitted may be unhealthful is the steaming process, in which it is suggested that young women and girls should not be employed.

In the final summary of the conclusions arrived at as the result of the inquiry, and after first pointing out that in some of the largest factories visited a very complete system of preliminary examination was in vogue whereby the physically unfit were eliminated, while in other factories where such a system was not in vogue the class of labor was decidedly inferior, it is stated that—

Our attention was drawn to a very interesting and important point by two of the doctors; their experience (which in one case had been tabulated) had led them to form the opinion that overtime has a very marked bearing on the normal health of the workers. They had noted an increase during and just after periods of overtime work of from one-third to one-half in the number of workers coming to them for treatment; the matters complained of were not anything special, but simply an increase in the usual form of ailment, such as indigestion, anæmia, heavy colds (in winter), gastric disorders in summer. When one considers that overtime here means simply employment up to the normal legal period, that is ten or ten and one-half hours a day, and does not mean overtime as permitted in a large number of industries (in the case of women over 18), and which extends to twelve hours' work in the day, the result is all the more striking, and one feels that a similar record in one of the industries in which overtime is allowed would produce more noticeable statistics of the results of overfatigue. The conclusion seems to us clear that eight and one-half to nine hours' work a day can not be exceeded by women and girls without overstrain and fatigue resulting in a lower standard of health.^a)

In 1905 a report was published by the Massachusetts state board of health of an investigation of the sanitary conditions of factories, workshops, and other places of employment, which included a brief consideration of the tobacco industry. Four factories were inspected, employing from 75 to 900 men and women, and the conditions observed were reported upon, in part, as follows:

In the operation of making cigars a great deal of dust arises, and in the three largest establishments visited the atmosphere was exceed-

^a Report of the Chief Inspector of Factories and Workshops for 1906, p. 254.

In this connection reference may be made to the Wisconsin law governing the construction, condition, and operations of cigar factories, reprinted in the Twenty-second Annual Report of the Commissioner of Labor, Labor Laws of the United States, p. 1424.

ingly bad from this cause and from overcrowding. In all three the sanitary arrangements were in most unsatisfactory condition. The habit of indiscriminate spitting was general, and it was noticed that many of the cigar makers completed each cigar with the aid of saliva. The possibility of disseminating loathsome diseases through this practice needs no extended discussion. Perhaps it would be fair to say that it is uncertain how long the germs of certain diseases which might appear to be transmissible in this manner may retain their vitality in contact with moist tobacco, but the idea is sufficiently revolting on æsthetic grounds alone. An objectionable practice, which obtains very generally and which should be the subject of some regulation, is the sale of sweepings. In the operation of making cigars considerable tobacco in larger or smaller pieces falls to the floor. At intervals these are swept up, sifted, and sold as fillings for cheaper cigars. Where the habit of promiscuous spitting prevails, the tobacco thus recovered is likely to be contaminated to some extent with disease organisms which may exist in the secretions of the mouth.^(a)

The report concludes with the statement that in one small factory in the western part of the State the atmosphere in the workroom was kept pure by means of mechanical ventilating appliances. In this factory no spitting was permitted, and the ends of the cigars were finished with the aid of gum tragacanth rather than with the workmen's saliva.

That the degree of consumption frequency among workers in tobacco is excessive, at least in American experience, is made evident by statistical data derived from the experience of the Cigar Makers' International Union, quoted in some detail in an editorial by the president of that organization in the Cigar Makers' Official Journal of September 15, 1906. After the statement that, according to the United States census of 1900, cigar makers ranked next to stonecutters in the relative mortality from consumption, it was observed that in 1890, 49 per cent of the deaths in the Cigar Makers' Union were from consumption. Five years later—that is, in 1895—only 35 per cent were from this cause, and in 1900 the percentage was only 33, which by 1905 had been further reduced to 24 per cent.

The opinion was expressed in the editorial that "the direct cause for this great disparity is almost wholly due to low wages, long hours and insanitary shop and home conditions, caused by inability to procure proper food, clothing, and home conditions."^(b)

This opinion is in accord with the views of many foreign authorities who have considered the sanitary conditions of employment in cigar factories and who attribute the relatively high death rate more to the conditions of work, neglect of sanitary precautions, long

^a Thirty-sixth Annual Report of the State Board of Health of Massachusetts, p. xxvi.

^b Editorial by G. W. Perkins, Cigar Makers' Official Journal, September 15, 1906, pp. 8 and 9.

hours of labor, low wages, and employment of women and children, than to the tobacco dust itself or to the presence of nicotine in the atmosphere.

Aside, however, from an improvement in the economic condition of union workmen, the writer above quoted readily concedes the necessity of sanitary regulation, concluding his remarks as follows:

In addition to the many excellent suggestions set forth, as a means of prevention, we suggest that all factories should be put in proper sanitary condition and properly ventilated. All operatives should be arranged so that they all face in one direction; in many factories the benches or tables are so arranged that the operatives face each other and those suffering from tuberculosis, when sneezing or coughing, or even talking and breathing, do so directly in the face of those sitting opposite. An ordinance should be passed in every municipality and State providing that the operatives should all face in one direction. This is an important remedy and can be executed without any additional cost to the manufacturers and employers. Those who will not adopt this plan should be forced to do so. As long as we have unsanitary shop conditions and illy paid operatives and poorly ventilated tenement house districts, tuberculosis and other wasting diseases will exist.^(a)

In 1907 the Massachusetts state board of health made a further report on the sanitary conditions of factories, etc., and in regard to cigar and cigarette making the conclusions were summarized as follows:

In the manufacture of cigarettes the baled tobacco leaves are first separated from one another, and the different kinds are then mixed on the floor in a long, low pile, and swept together with a broom. From time to time, as more tobacco is added, the pile is sprayed with water. After standing several hours to "blend" the material is taken to the cutting machine. After being cut, it is shaken up on a broad bench to make it "stringy." In this process more or less tobacco dust is caused to fly about. The tobacco is then conveyed to the making room in zinc-lined boxes. Here it is rolled up in a bit of parchment paper, which, with its contents, is slipped into a paper tube, and then the parchment is withdrawn. The loose ends are then trimmed and the cigarette is ready for the drying room, where it is kept several days, in order to be brought to the required degree of dryness (or moisture). The paper tubes are stuck together with starch paste, to which a little wheaten flour is added.^(b)

The foregoing observations are based upon the inspection of 134 cigar factories and 11 cigarette factories, including establishments of all sizes, from those employing fewer than five persons to those employing many hundred. As regards light, ventilation, and general sanitation, it was found that 127 establishments were reported as be-

^a Editorial by G. W. Perkins, Cigar Makers' Official Journal, September 15, 1906, p. 9.

^b Report of the Massachusetts State Board of Health upon the Sanitary Condition of Factories, Workshops, etc., 1907, pp. 49, 50.

ing in from fair to good sanitary condition, while in 18 the general conditions observed were moderately or distinctly bad, but in the industry as a whole certain highly objectionable practices were found to prevail extensively, it being stated that—

The spitting habit, for example, is especially common; and, apart from the danger to which the health of the employees is thereby exposed, is particularly to be deprecated, in view of the fact that in the processes of manufacture considerable tobacco falls to the floor, and these fragments, if not gathered up and used on the premises, are very commonly swept up with all the dirt, dried sputum, and other matter, and sold as filling for cheap cigars.^(a)

The report very properly calls attention to the risk of disseminating loathsome diseases through the practice of finishing cigars with the aid of saliva, and it is stated further that in 18 factories the practice of biting off the end of the filler and inner wrapper with the teeth was also observed. In a number of factories there was much overcrowding, some were very dusty, some very dirty in every part, and some extremely hot and foul smelling. A fairly large proportion of the employees were found to look pale and sickly, and in some of the larger factories this proportion was noted as about one-tenth.

The Massachusetts investigation proves conclusively the necessity of thorough and qualified inquiry into the actual facts, rather than reliance upon broad generalization, more or less inapplicable to the industry in all its parts.

In the occupation mortality statistics of the Twelfth Census it is shown that of the 478 deaths of male cigar makers of known ages reported in the registration States, 122, or 25.5 per cent, were from consumption, and 80, or 16.7 per cent, were from other respiratory diseases. The census comparative death rates from all causes were as follows:

MORTALITY FROM ALL CAUSES AMONG CIGAR MAKERS AND TOBACCO WORKERS, COMPARED WITH THAT OF THE MANUFACTURING AND MECHANICAL CLASS AND THE MERCANTILE AND TRADING CLASS IN THE REGISTRATION STATES, 1900, BY AGE GROUPS.

[From report on Vital Statistics, Twelfth Census of the United States, 1900.]

Age at death.	Death rate per 1,000 among—		
	Cigar makers and tobacco workers.	The manufacturing and mechanical class.	The mercantile and trading class.
15 to 24 years	5.85	4.43	2.60
25 to 44 years	14.59	8.35	6.72
45 to 64 years	30.97	20.16	19.91
65 years and over.....	120.61	105.43	93.79

^a Report of the Massachusetts State Board of Health upon the Sanitary Condition of Factories, Workshops, etc., 1907, pp. 49, 50.

According to this table, the death rate of cigar makers and tobacco workers at ages 15 to 24 was 5.85 per 1,000, compared with 4.43 for men in the mechanical and manufacturing class and 2.60 for the mercantile and trading class. At the other specified ages the mortality from all causes among tobacco workers was considerably in excess of that in the other two selected groups of occupations.

In Rhode Island, out of 115 deaths of cigar makers recorded during the period 1852 to 1906, 46, or 40 per cent, were from consumption, and 10, or 8.7 per cent, from other respiratory diseases.

Regarding tobaccoists, which term includes all persons employed in tobacco manufacture, the report of the registrar-general on the occupation mortality of England and Wales for 1900 to 1902 contains the following:

There were enumerated at the last census 17,607 males above the age of 15 years, of whom 17,192 were occupied; the latter being an increase of 37 per cent on the number enumerated at the previous census. At all age groups up to 35 years the mortality of tobaccoists exceeds that of occupied and retired males generally, and at ages 45 to 55 the rates are about equal. At the higher ages the death rates of tobaccoists are below the standard. Their comparative mortality figure is 962, or 4 per cent below the average for occupied and retired males. The mortality of tobaccoists from cancer, circulatory diseases, and suicide is considerably below the standard, and they are remarkably free from fatal accidents. From alcoholism and liver disease, from nervous diseases, from phthisis, and from Bright's disease, however, they suffer excessive mortality.^(a)

The most recent English mortality statistics for male tobacco workers include 646 deaths from all causes occurring during the three-year period ending with 1902. Of this number of deaths, 145, or 22.4 per cent, were from consumption and 125, or 19.3 per cent, were from other respiratory diseases, which combined give 41.7 per cent of the total mortality from diseases of the lungs and air passages. In the table which follows a comparison is made of the mortality from all causes among men in this group with that of occupied males generally, and the result is suggestive of conditions in these trades unfavorable to health and life at ages under 35.

^a Part II. Supplement to the Sixty-fifth Annual Report of the Registrar-General of Births, Deaths, and Marriages in England and Wales, p. liii. London, 1908.

MORTALITY FROM ALL CAUSES AMONG TOBACCO WORKERS, COMPARED WITH THAT OF ALL OCCUPIED MALES IN ENGLAND AND WALES, 1900 TO 1902, BY AGE GROUPS.

[From Part II, Supplement to the Sixty-fifth Annual Report of the Registrar-General of Births, Deaths, and Marriages in England and Wales.]

Age at death.	Death rate per 1,000 for all occupied males.	Death rate for tobacco workers.		
		Rate per 1,000.	Greater (+) or less (-) than rate for all occupied males.	Ratio to rate for all occupied males.
15 to 19 years.....	2.44	2.76	+ 0.32	113
20 to 24 years.....	4.41	5.88	+ 1.47	133
25 to 34 years.....	6.01	6.76	+ 0.75	112
35 to 44 years.....	10.22	9.28	- .94	91
45 to 54 years.....	17.73	17.21	- .52	97
55 to 64 years.....	31.01	28.89	- 2.12	93
65 years and over	88.39	67.83	-20.56	77

The death rates of men employed in tobacco manufacture are below the general average at ages over 35, but the difference is small except at ages 65 and over when the number of persons employed is too small to make the death rates trustworthy.

In the table which follows the mortality from consumption and from respiratory diseases other than consumption among male tobacco workers is compared with the normal mortality of occupied males from these diseases by divisional periods of life. The comparison shows that the mortality from consumption was above the average at ages 20 to 54. The mortality from other respiratory diseases was excessive at ages 15 to 24 and at ages 35 to 54.

MORTALITY FROM CONSUMPTION AND FROM OTHER DISEASES OF THE RESPIRATORY SYSTEM AMONG TOBACCO WORKERS, COMPARED WITH THAT OF ALL OCCUPIED MALES IN ENGLAND AND WALES, 1900 TO 1902, BY AGE GROUPS.

[From Part II, Supplement to the Sixty-fifth Annual Report of the Registrar-General of Births, Deaths, and Marriages in England and Wales.]

Age at death.	Mortality from consumption.				Mortality from other diseases of the respiratory system.			
	Death rate per 1,000 for all occupied males.	Death rate for tobacco workers.			Death rate per 1,000 for all occupied males.	Death rate for tobacco workers.		
		Rate per 1,000.	Greater (+) or less (-) than rate for all occupied males.	Ratio to rate for all occupied males.		Rate per 1,000.	Greater (+) or less (-) than rate for all occupied males.	Ratio to rate for all occupied males.
15 to 19 years....	0.54	0.44	-0.10	81	0.24	0.29	+0.05	121
20 to 24 years....	1.55	3.09	+1.54	199	.48	.59	+ .11	123
25 to 34 years....	2.03	3.54	+1.51	174	.77	.69	- .08	90
35 to 44 years....	2.74	3.43	+ .69	125	1.66	2.23	+ .57	134
45 to 54 years....	3.04	3.68	+ .64	121	3.32	3.55	+ .23	107
55 to 64 years....	2.16	2.03	- .13	94	6.54	5.19	-1.35	79
65 years and over	1.11	.48	- .63	43	17.77	17.44	- .33	98

The following statistics from the occupational mortality returns of Switzerland indicate that tobacco workers in that country experience an excessive mortality from consumption at ages 40 and over, but at the younger ages the mortality from that cause is considerably less than that of all occupied males:

MORTALITY FROM CONSUMPTION AMONG TOBACCO WORKERS AND CIGAR MAKERS, COMPARED WITH THAT OF ALL OCCUPIED MALES IN SWITZERLAND, 1879 TO 1890, BY AGE GROUPS.

[Figures from Vital Statistics of Switzerland, 1871 to 1890, Part III.]

Age at death.	Death rate per 1,000 for all occupied males.	Death rate for tobacco workers and cigar makers.		
		Rate per 1,000.	Greater (+) or less (−) than rate for all occupied males.	Ratio to rate for all occupied males.
15 to 19 years.....	1.30	0.83	−0.47	64
20 to 29 years.....	3.04	2.00	−1.04	66
30 to 39 years.....	3.66	3.35	−.31	92
40 to 49 years.....	3.65	4.22	+ .57	116
50 to 59 years.....	3.52	4.01	+ .49	114
60 to 69 years.....	3.25	3.55	+ .30	109
70 years and over.....	1.84	.....	.....	.....

The recorded industrial insurance mortality statistics of tobacco workers include three groups of employees: Tobacco workers not otherwise specified, tobacco and cigar dealers, and cigar and cigarette makers and packers. The industrial insurance mortality statistics of tobacco workers not otherwise specified, include 141 deaths from all causes, of which 49, or 34.8 per cent, were from consumption. Of the mortality of this group from other respiratory diseases 7 were from pneumonia, 3 were from asthma, 3 from bronchitis, and 1 from another respiratory disease. If the deaths from consumption and from other respiratory diseases are combined, it is found that 44.7 per cent of the mortality was from diseases of the lungs and air passages. The mortality from consumption was excessive at all ages, as is set forth in detail in the following tabular analysis:

PROPORTIONATE MORTALITY FROM CONSUMPTION AMONG **TOBACCO WORKERS**, 1897 TO 1906, COMPARED WITH THAT OF ALL MALES IN THE REGISTRATION AREA OF THE UNITED STATES, 1900 TO 1906, BY AGE GROUPS.

[Figures for tobacco workers from experience of an industrial insurance company; figures for males in registration area computed from mortality statistics of the United States census.]

Age at death.	Deaths of tobacco workers, 1897 to 1906, due to—		Per cent of deaths due to consumption among—	
	All causes.	Consumption.	Tobacco workers.	Males in registration area, 1900 to 1906.
15 to 24 years.....	28	10	35.7	27.8
25 to 34 years.....	31	15	48.4	31.3
35 to 44 years.....	26	11	42.3	23.6
45 to 54 years.....	21	8	38.1	15.0
55 to 64 years.....	21	4	19.0	8.1
65 years and over.....	14	1	7.1	2.7
Total.....	141	49	34.8	14.8

The recorded industrial insurance mortality statistics of tobacco and cigar dealers include 196 deaths from all causes, of which 43, or 21.9 per cent, were from consumption. Of the mortality of this group from other respiratory diseases 23 were from pneumonia, 7 from bronchitis, 6 from asthma, and 1 from another respiratory disease. If the deaths from consumption and from other respiratory diseases are combined, it is found that 40.8 per cent was from diseases of the lungs and air passages.

PROPORTIONATE MORTALITY FROM CONSUMPTION AMONG **TOBACCO AND CIGAR DEALERS**, 1897 TO 1906, COMPARED WITH THAT OF ALL MALES IN THE REGISTRATION AREA OF THE UNITED STATES, 1900 TO 1906, BY AGE GROUPS.

[Figures for tobacco and cigar dealers from experience of an industrial insurance company; figures for males in registration area computed from mortality statistics of the United States census.]

Age at death.	Deaths of tobacco and cigar dealers, 1897 to 1906, due to—		Per cent of deaths due to consumption among—	
	All causes.	Consumption.	Tobacco and cigar dealers.	Males in registration area, 1900 to 1906.
15 to 24 years.....	14	5	35.7	27.8
25 to 34 years.....	34	15	44.1	31.3
35 to 44 years.....	35	12	34.3	23.6
45 to 54 years.....	29	4	13.8	15.0
55 to 64 years.....	40	4	10.0	8.1
65 years and over.....	44	3	6.8	2.7
Total.....	196	43	21.9	14.8

The recorded industrial insurance mortality statistics of cigar and cigarette makers and packers include 1,530 male deaths from all causes, of which 442, or 28.9 per cent, were from consumption. Of the

mortality of this group from other respiratory diseases, 118 were from pneumonia, 22 from bronchitis, 16 from asthma, and 24 from less frequent respiratory diseases. If the deaths from consumption and from other respiratory diseases are combined, it is found that 40.7 per cent of the mortality of cigar and cigarette makers and packers was from diseases of the lungs and air passages. The consumption mortality of this group of male workers was excessive at all ages, as is set forth in detail in the following table:

PROPORTIONATE MORTALITY FROM CONSUMPTION AMONG CIGAR MAKERS AND PACKERS, 1897 TO 1906, COMPARED WITH THAT OF ALL MALES IN THE REGISTRATION AREA OF THE UNITED STATES, 1900 TO 1906, BY AGE GROUPS.

[Figures for cigar makers and packers from experience of an industrial insurance company; figures for males in registration area computed from mortality statistics of the United States census.]

Age at death.	Deaths of cigar makers and packers, 1897 to 1906, due to—		Per cent of deaths due to consumption among—	
	All causes.	Consumption.	Cigarmakers and packers.	Males in registration area, 1900 to 1906.
15 to 24 years.....	131	57	43.5	27.8
25 to 34 years.....	267	147	55.1	31.3
35 to 44 years.....	281	119	42.3	23.6
45 to 54 years.....	325	67	20.6	15.0
55 to 64 years.....	284	36	12.7	8.1
65 years and over.....	242	16	6.6	2.7
Total.....	1,580	442	28.9	14.8

The preceding observations and statistical data, derived from both American and foreign sources, clearly indicate that tobacco workers are subject to an excessive mortality from consumption and from other respiratory diseases.

THE MANUFACTURE OF SNUFF.

The manufacture of snuff in the United States was carried on in 41 establishments, employing 946 wage-earners in 1905, according to the returns of the factory census for that year.

In an earlier special report on the industry, made as part of the census of 1900, the process of snuff manufacture is described in part as follows:

The making of snuff is the most complicated of all the processes of tobacco manufacture. This article, as found on the market, may be roughly divided into two classes, namely, dry and moist, each of which varies greatly in quality. Snuff is sometimes manufactured in connection with cigars and chewing tobacco, as it affords an opportunity to utilize the parts of the leaf not consumed in those products. The material for dry snuffs is first dampened and put through cutting machines, which chop it finely. It is then subjected to a high temperature and rendered perfectly dry, when it is ready for grind-

ing. The grinding machines preserve much of the principle governing the first manufacture of snuff, which was reduced to a rough powder by pounding or grating. The commonest form of grinding machine consists of a receptacle shaped like the frustum of a cone inverted. A set of rollers of corresponding inclination revolve close to the inner surface, grinding the tobacco between to a fine powder. The finished article is packed by machine packers into bladders, tin cans, earthenware jars, glass tumblers, etc. Scotch, Irish, and Welsh snuffs are the commonest forms of the dry class.

Moist snuffs are of infinite variety. The material used in their manufacture is moist when ground, and is not reduced to a fine powder like the dry snuffs. After grinding, the "flour" is subjected to as many different processes and manipulations as there are manufacturers. Many of these involve frequent handling and bulking to control the different stages of sweating or fermentation which gives character to the finished article, darkening it and developing its peculiar flavor. In addition to saucing, fermentation, and manipulation, ingredients are added to flavor and perfume.^(a)

The foregoing descriptive account emphasizes the more important factors detrimental to health, chiefly, of course, the production of considerable quantities of very fine tobacco dust, practically unavoidable under the conditions under which the industry is carried on at the present time. Of all the products of tobacco snuff requires the most complicated processes of manufacture, which vary only according as the article produced comes under the head of dry or moist, but because of the fact that it is possible to utilize much waste material in producing snuff it is frequently made in connection with cigars and chewing tobacco. In brief, the health-injurious circumstances incidental to the manufacture of tobacco are emphasized in the manufacture of snuff, and most of the authorities on occupation diseases lay much stress upon this fact, which was early recognized by Ramazzini, when, however, this branch of the industry was the most important instead of being of very limited extent, as it is at the present time.

Thackrah refers to the occupation in a brief statement, holding that snuff making is more pernicious than tobacco manufacture in general, and that the fine dust, combined with muriate of ammonia and other substances, produces disorders of the head, the air tubes, and the stomach.

In another descriptive account of the industry as carried on in New York, the assistant inspector of the board of health, reported, in 1872, that—

In one of the largest manufactories in the city (Lorillard's), the atmosphere of the room in which the snuff is packed in bags is so full of flying particles as almost to be opaque, and I could not remain inside, even a few seconds, without experiencing the most violent

^a Report on Manufactures, Part III, Twelfth Census of the United States, 1900, p. 672.

irritation of the whole respiratory mucous membrane; and yet, in this atmosphere, inhaling with every breath thousands of particles of a most irritating powder, works a man, who has been employed in the same way, day after day, for twenty years, and he assured me that he had not had a day of sickness, and that he was, in every way, in perfect health. His face was so smeared with yellow snuff that I could not discern if his complexion were natural or not; but he told me his appetite was excellent, and all his bodily functions were carried on with perfect regularity.^(a)

Dr. B. W. Richardson, in his lectures on "Unhealthy trades," before the Society of Arts, in 1872, referred to the manufacture of snuff as a health-injurious occupation, at considerable length, his remarks in full being as follows:

The dust produced in the various processes of snuff making is still more injurious [than that in cigar making]. The tobacco leaf, finely cut up, is mixed with lime-water, salt, sometimes even floor-dust sweepings, and, in yellow snuff, with red lead. These ingredients placed in a bin and heated two or three times to give sharpness to the snuff, are frequently turned over, in order to facilitate the process of drying. While this turning is in progress, there arises a dust with a smoke, which affects the younger workmen, so that they become faint and vomit, until, by use, they are rendered tolerant of the poisonous matters they inhale. In the further process of finishing the snuff, after it has been ground and dried, there is a practice of what is called sifting, preparatory to adding "liquor"—namely, salt and water—to make weight, and scents to give perfume. The sifting charges the air with dust, which is as injurious as the smoke, and which produces the same symptoms in the young—namely, retching, faintness, and great irritation of the bronchial passages. The rooms in which these works are carried on are too often close and unventilated, and thereby the irritation of the throat, the cough, and the nausea are much increased. Sifting the "shorts" is more hurtful than rolling the cigar. The consolation of the workman is that he gets accustomed to the poison, if he only keeps to the work, and at last gets over the symptoms. In so far as the acuteness of the symptoms is concerned, he is generally correct in this respect, but it is not to be presumed that the mischief stops at this point. The system of the workman becomes tolerant in some measure, but the tolerance is partial only. Chronic maladies are induced by continued application, which are of serious and even fatal import. Those workmen who are disposed to pulmonary consumption suffer readily from that disease, and in others of better constitution, less serious, but still serious derangements are manifested, the most common of which are a persistent dyspepsia and that pale and bloodless condition to which the technical term anæmia is applied by the physician. Another common symptom is a rapid and irregular action of the heart. Palpitation of the heart and intermittent action, in which the organ hesitates in its beat, are marked phenomena. I think I may indeed say that in these workmen the action of the heart is never at its full power,

^a Third Annual Report of the Board of Health of the City of New York, 1873, pp. 309, 310.

never perfectly regular so long as they are following their employment. In cases where the chronic effects are most intense, the muscles of the body share in the feebleness and disturbance. The hands become tremulous, the lower limbs unsteady. In two examples, I have seen the breathing muscles influenced, and a peculiar spasm of an extremely painful kind produced through the chest, followed by faintness, as if the sufferer were about to die. Lastly, the organs of the senses become impaired from these occupations, and there is deafness and imperfect vision, so that light becomes extremely painful to the eye. It is unfortunate that this occupation leads often to abuse in the habits of smoking and chewing tobacco. When this occurs, the evil consequences are greatly increased. I believe few workmen escape altogether the dangers I have named. Not many are able to carry on their business beyond the fortieth year.^a

The views of other authorities on the diseases of trades concur more or less in the foregoing opinions, summarized in the statement that the very considerable amount of dust produced in snuff manufacture is unquestionably detrimental to health, at least in the case of those who continue the employment for a long period of time. No statistical data are available to sustain these conclusions, but the large amount of available information regarding workers in tobacco generally would seem to support the point of view that the manufacture of snuff is detrimental to health and a more or less predisposing factor to consumption by the constant irritation of the respiratory passages, followed by a decrease in the vital resistance generally.

LEATHER WORKERS.

The manufacture of leather in all its branches gives employment to over a quarter of a million wage-earners, estimated by the census of 1900 as 251,920, of which 52,109 were engaged in leather tanning, currying, and finishing. The tendency of the industry is toward consolidation, as is made evident by the fact that the census of 1880 returned 5,426 establishments, the census of 1890 returned 1,744 and the census of 1900 returned 1,306. The amount of capital invested, the cost of materials used, and the value of the products have considerably increased during the intervening period. The changes which have occurred and which have an immediate bearing upon the health conditions in the various trades involved, are briefly referred to in the census reports, it being stated that—

It is a curious feature of the business that, while in nearly every other industry advantage has been taken of labor-saving devices as they have been perfected, leather manufacturers were inclined, until about 1880, to discourage any attempt to supersede manual labor with machinery. They preferred, also, to adhere to the formula

^a Scientific American Supplement, March 4, 1876, p. 154.

and tanning processes which had been handed down for generations from father to son, rather than to take advantage of the scientific knowledge which the chemists had to offer them in the way of improved and more economical methods. As a result of these prejudices, the evolution of the business, until recently, was very slow. During the past twenty years, however, the most radical changes have taken place, so that this industry has been completely revolutionized, and the up-to-date leather manufactory is now equipped with numerous appliances for manipulating the hide during the various stages through which it passes from the lime vat to the leather stretching and measuring machines. Many patented processes and compounds for tanning and tawing, as well as for depilating hides and skins, are also in use, so that it may be said with truth that the present-day leather manufacturer is no less enterprising in the use of what modern invention has to offer him than the leaders in any other line of productive industry.^(a)

The tanner has now at his command mechanical appliances for carrying the work through the various stages from the beam house to the final measuring of the material, as in the case of upper leather, preparatory to its shipment to the customer. The bark mill, that most important adjunct to the tanner using oak, hemlock, or union tannages, has undergone much improvement of late years. The present saw grinders or cutters overcome defects which were common to bark mills of a few days ago, while the resultant material is so leached that the utmost of its tannin is extracted, which was not formerly the case. In the handling of the hides, the reel, the rocker handler, the skeleton drum, and other labor-saving devices have done their part toward simplifying the work and reducing the cost. The processes subsequent to the removal of the leather from the bath have also been rendered less laborious and less costly by the introduction of mechanical scrubbers, power rollers, scouring and stuffing wheels, stretchers, etc.^(b)

Under modern conditions the processes of tanning, currying, and leather finishing are less injurious to health and life than they must have been under former conditions when the methods of manufacture were more arduous as well as more offensive. Ramazzini, in his *Treatise of the Diseases of Tradesmen*, observed that in consequence of exposure to odors and foul exhalations the complexion of tanners was deathlike, their bodies were puffed up, and their breathing was difficult. Thackrah, writing in 1832, remarks that—

They [tanners] work in an atmosphere largely impregnated with the vapor of putrifying skins, and this combined with the smell of lime in one place, and of tan in another. They are exposed constantly to wet and cold. Their feet are scarcely ever dry. Yet they are remarkably robust; the countenance florid; and disease almost un-

^a Report on Manufactures, Part III, Twelfth Census of the United States, 1900, p. 704.

^b *Idem*, p. 713.

known. Tanners are said to be exempt from consumption. We have carefully inquired at several tan-yards, and could not hear of a single example of this formidable disease. We do not find old men actually in the employ; and the reason assigned is, not the decline of health, but the inferiority of men past middle age, in undergoing the labor of the process. Persons, however, in advanced life, yet healthy, are found in other occupations, who have before been for many years in the tan-yards, and have not apparently suffered from the long-continued exposure to their offensive odor. Hence we may infer that this employ, while it invigorates the constitution in youth and middle age, does not sensibly shorten life; does not, in other words, give temporary health at the expense of premature decline.^(a)

This favorable statement regarding the occupation is not sustained by the facts of actual experience, although Thackrah quotes Doctor Dods, who, in the Medical Gazette, had stated that he had "not been able to discover one unequivocal instance of death to have taken place in an operative tanner from phthisis, in its tubercular form, in any part of this Kingdom," and who attributed this alleged exemption of tanners from consumption to the peculiar aroma of volatile matter constantly arising from the tan pits, as the result of which tanners, in his opinion, were exempted from consumption.

Doctor Halfort, a German authority on the diseases of trades, writing in 1845, included curriers and similar occupations among the exceptionally healthful trades, stating in particular that phthisis was practically unknown among them, but apparently basing his conclusions entirely on Thackrah's observations.^(b)

The same opinion was held by Wynter, who, writing in 1860, observed that "tanners are rarely, we believe, attacked with phthisis."^(c)

Arlidge, writing in 1892, observes, with respect to curriers, that—

The business of the currier is one of simple mechanical work, and is for the most part pursued in conjunction with that of tanning and leather-dressing. The operation consists almost entirely of strong rubbing of the leather on a table with a wooden tool, whereby the "grain" is raised; at the same time a grease is rubbed in until it penetrates the substance at all points. When a black color is required, lamp-black mixed with oil and size is employed. Other colors are got by various chemical compounds, some of which probably are not quite innocent. Nevertheless, the work of the currier may be pronounced free from any distinct injury to health. It entails active movement of the arms, and a constant bending forward of the trunk in the act of rubbing.^(d)

^a Effects of Arts, Trades, and Professions on Health and Longevity, by C. Turner Thackrah, 1832, p. 61.

^b Diseases of Artisans, by A. C. L. Halfort, M. D., 1845, p. 283.

^c Curiosities of Civilization, p. 514.

^d Diseases of Occupations, by J. T. Arlidge, p. 219.

The same writer, however, observes that in the business of leather dressing and coloring where the red color is required there is danger of arsenical poisoning; and again in the varnish or enamel for dress shoes lead is a constituent, and consequently a possible source of plumbism to those who apply it on the leather, as well as to those who prepare it. In none of these occupations does there appear to be a decided exposure to health-injurious dust.

Leather making in its various branches was later considered by Parry, who describes the various operations, but the dangers which may arise in the course of manufacture are held to be limited to (1) anthrax, (2) lead poisoning, (3) arsenical poisoning, and (4) poisoning by various gases. Apparently there is no particular exposure to health-injurious dust.

A very important report upon the effect of occupation on the health and duration of trade life of men employed in the leather industry was published by the New Jersey bureau of labor statistics, in 1894, including observations upon 1,124 wage-earners, subdivided into japanners (258), leather makers (198), curriers (125), beamsmen (111), tanners (194), splitters (76), grainers (38), tackers (33), buffers (14), shavers (6), softeners (22), and finishers (49). In commenting upon the statistical results of the investigation, it is pointed out that tanning is mostly hand labor and very laborious. While in some departments the workmen are subject to dampness, they are rugged and seem to be no more liable to colds than workmen in any ordinary occupations. The odor arising from the material used is disagreeable to those not accustomed to it, but there are no substances used that are deleterious to health. On the contrary, the lime, oil, and bark used are considered beneficial to health; and finally, that "there is little or no dust in any of the processes."

In 1907 the Massachusetts state board of health published a report on the sanitary conditions of factories, etc., and included the manufacture of leather, of which the various processes are described at some length, it being pointed out that the leather industry is one that calls for strength and endurance, and that all of the processes demand the services of men of good physical strength. The report concludes with the statement that—

In the various processes of drying, stretching, stuffing, hand-whitening, blacking, and polishing there are no features which are intrinsically dangerous to health in any way; but the process of buffing on wheels or revolving drums covered with sandpaper gives rise to considerable dust, which, even when exhaust fans are installed for its removal, escapes in most instances to a greater or lesser extent into the air of the room. In one of the establishments visited, for example, where every part was found to be kept scrupulously clean and neat, and where the beam house, ordinarily a most offensive

place, was conspicuously clean and free from objectionable odors, the air of the buffing room was filled with fine dust.^(a)

This reference to dust exposure in the particular process of buffing, which is characteristic of the manufacture of chrome-tanned leather, is the first in the literature of occupation diseases. It is stated in the report that "8 tanning establishments, employing from 28 men in one instance to 1,100 in another, and about 2,300 in all, showed conditions which in the least pretentious were at least fairly commendable, and in the most approved were as praiseworthy as those met with in cleaner occupations. The business is one in which overcrowding is hardly possible and free ventilation most desirable; and, as is to be expected in a nondusty trade requiring strength and endurance, the employees are healthy appearing and well nourished. The only objectionable conditions noted were the dusty atmosphere incident to buffing, and exposure to fumes of naphtha, amyl acetate, and wood alcohol."^(b)

That the exposure to dust in the buffing process is a very serious one is made evident by the consideration which has been given to the subject by fire insurance companies, who have instituted special investigations to ascertain, if possible, the fire hazard attaching to the buffing dust of chrome-tanned leather, several fires having occurred which apparently had their origin in the dust generated in connection with this process of manufacture.

A brief reference may be made to the danger from anthrax, which is a more serious one than generally assumed. The risk is referred to by most of the authorities on occupation diseases, and at some length by D'Arcy Power, in *Oliver's Dangerous Trades*, and by W. H. Hamer, in an article contributed to the same work.^(c) In a paper read in 1898 before the American Public Health Association in Philadelphia, by Dr. M. P. Ravenel, it is stated that in 1897 "from reports which I have not been able to entirely verify, it is likely that so many as 12 men and 60 head of cattle died of anthrax near tanneries in this State [Pennsylvania] during the year."^(d) According to statements made by state medical inspectors of Pennsylvania there were four deaths from anthrax among the employees of the Falls Creek tannery, at Falls Creek, near Clearfield, Pa., attributed to the handling of hides imported from China, and similar cases were reported from Proctor, Lycoming County, Pa., and other localities.^(e) Since one

^a Report of the Massachusetts State Board of Health upon the Sanitary Condition of Factories, Workshops, etc., 1907, p. 116.

^b *Idem*, p. 117.

^c *Dangerous Trades*, by Thomas Oliver, pp. 244, 621-633.

^d "Anthrax.—The influence of tanneries in spreading the disease," by M. P. Ravenel, *Philadelphia Medical Journal*, April 22, 1899, p. 897.

^e Reports of the State Board of Health of Pennsylvania for 1897 (pp. 90, 104, 589) and for 1898 (p. 158).

of the characteristics of anthrax infection, as disclosed by post-mortem examination, is the enlargement of the spleen, it is quite probable—from the reference which Ramazzini in 1670 made to the fact, as observed by him at that time, that most of the tanners were “splenetick”—that anthrax, under the earlier and much less sanitary conditions, was very much more common among tanners than it is at the present time. While the mortality from this disease among tanners is small, it is nevertheless an occupation risk of very material importance.

The census mortality statistics for 1900 return 206 deaths of leather makers. In the mortality from all causes the death rate was comparatively low at all ages, as shown in detail in the following table:

MORTALITY FROM ALL CAUSES AMONG LEATHER MAKERS, COMPARED WITH THAT OF THE MANUFACTURING AND MECHANICAL CLASS AND THE MERCANTILE AND TRADING CLASS, IN THE REGISTRATION STATES, 1900, BY AGE GROUPS.

[From report on Vital Statistics, Twelfth Census of the United States, 1900.]

Age at death.	Death rate per 1,000 among—		
	Leather makers.	The manufacturing and mechanical class.	The mercantile and trading class.
15 to 24 years	3.5	4.4	2.6
25 to 44 years	7.8	8.4	6.7
45 to 64 years	19.7	20.2	19.9
65 years and over.....	94.2	105.4	93.8

From the above table it is shown that at ages 15 to 24 the general death rate of leather makers was 3.5 per 1,000, compared with 4.4 for the manufacturing and mechanical class and 2.6 for the mercantile and trading class. At the other ages also the comparison is favorable to leather makers.

The recorded industrial insurance mortality statistics of leather workers include 641 deaths from all causes, of which 206, or 32.1 per cent, were from consumption. Of the mortality of leather workers from respiratory diseases other than consumption, 62 were from pneumonia, 11 from bronchitis, 6 from asthma, and 10 from less frequent respiratory diseases. If the deaths from consumption and from respiratory diseases other than consumption are combined, it is found that 46.0 per cent of the mortality of leather workers was from diseases of the lungs and air passages. While, therefore, the general death rate among leather workers is shown to compare favorably with other manufacturing industries, the mortality from consumption and from other respiratory diseases among leather workers is shown to be somewhat excessive, due probably, in part at least, to

the inhalation of animal dust. The following tabular analysis of the industrial insurance mortality statistics shows in detail the proportionate mortality from consumption among leather workers by divisional periods of life. While the proportionate mortality from consumption was excessive among leather workers at all ages under 65, the excess was most pronounced at ages 25 to 34, when out of every 100 deaths from all causes 50 were due to consumption, against an expected normal proportion of 31.3 per cent. The analysis of the consumption mortality of leather workers is set forth in detail in the following table:

PROPORTIONATE MORTALITY FROM CONSUMPTION AMONG LEATHER WORKERS, 1897 TO 1906, COMPARED WITH THAT OF ALL MALES IN THE REGISTRATION AREA OF THE UNITED STATES, 1900 TO 1906, BY AGE GROUPS

[Figures for leather workers from experience of an industrial insurance company; figures for males in registration area computed from mortality statistics of the United States census.]

Age at death.	Deaths of leather workers, 1897 to 1906, due to—		Per cent of death due to consumption among—	
	All causes.	Consumption.	Leather workers.	Males in registration area, 1900 to 1906.
15 to 24 years.....	92	35	38.0	27.1
25 to 34 years.....	154	77	50.0	31.3
35 to 44 years.....	155	55	35.5	23.5
45 to 54 years.....	99	29	29.3	15.1
55 to 64 years.....	79	9	11.4	8.1
65 years and over.....	62	1	1.6	2.1
Total.....	641	206	32.1	14.1

The preceding observations and statistical data are more or less inconclusive except the insurance mortality experience, which clearly indicates a decided excess in the mortality from consumption among leather workers at all ages under 65. In the absence of a thoroughly qualified and extensive investigation, it is impossible to state how far the higher death rate is the direct result of dust exposure, but there can be no doubt that the dust problem in some branches of the industry is a serious one from a sanitary point of view. It is necessary, however, to keep in mind that intemperate habits prevail to a considerable extent among leather workers, and in particular among tanners, but this evil, in itself, does not account for the higher mortality brought out by the recorded insurance experience data.

TANNERS, CURRIERS, AND BEAMERS.

The statistics thus far given relate to leather workers in general. There is statistical information, however, for certain leather trades including tannery employees and harness and saddle makers. In the first class are included tanners, curriers, beamers, etc. In Rhode

Island, during the period 1852 to 1906 there were 66 deaths recorded of tanners and curriers, and of this number only 6, or 9.1 per cent, died from consumption, and 5, or 7.6 per cent, from respiratory diseases other than consumption. These statistics, therefore, indicate a favorable mortality experience in Rhode Island for tanners and curriers.

Regarding tanners, the report of the registrar-general on the occupation mortality of England and Wales for 1900 to 1902 contains the following:

At the earlier and later ages the mortality of tanners differs little from the standard for all occupied and retired males, but between the ages 20 and 45 it falls considerably below the average. In the main working period of life the comparative mortality figure is 774, or 23 per cent below the standard. The mortality of tanners from Bright's disease and from suicide appears to be slightly above the average, but under every other heading the mortality is low.^(a)

The most recent English mortality statistics for tanners indicate that this branch of the leather industry is quite satisfactory as regards the mortality from all causes. The general death rate compares favorably with that for all occupied males, as is indicated in the following table:

MORTALITY FROM ALL CAUSES AMONG TANNERS, COMPARED WITH THAT OF ALL OCCUPIED MALES IN ENGLAND AND WALES, 1900 TO 1902, BY AGE GROUPS.

[From Part II, Supplement to the Sixty-fifth Annual Report of the Registrar-General of Births, Deaths, and Marriages in England and Wales.]

Age at death.	Death rate per 1,000 for all occupied males.	Death rate for tanners.		
		Rate per 1,000.	Greater (+) or less (-) than rate for all occupied males.	Ratio to rate for all occupied males.
15 to 19 years.....	2.44	2.51	+0.07	103
20 to 24 years.....	4.41	3.27	-1.14	74
25 to 34 years.....	6.01	3.83	-2.18	64
35 to 44 years.....	10.22	5.77	-4.45	56
45 to 54 years.....	17.73	15.07	-2.66	85
55 to 64 years.....	31.01	30.87	-.14	100
65 years and over	88.89	89.45	+1.06	101

The preceding table is self-explanatory and requires no further comment. A more extended comparison, however, is made in the next table, in which the mortality of tanners from consumption and other respiratory diseases is compared with the normal mortality of occupied males from these diseases by divisional periods of life. The comparison shows that the mortality from consumption among tanners is somewhat excessive at ages 15 to 19 and 45 to 64;

^a Part II, Supplement to the Sixty-fifth Annual Report of the Registrar-General of Births, Deaths, and Marriages in England and Wales, p. lxxv. London, 1908.

at ages 20 to 44 the mortality from consumption is somewhat less than for all occupied males. The differences are comparatively slight at all ages, and the same is true of the mortality from respiratory diseases other than consumption.

MORTALITY FROM CONSUMPTION AND FROM OTHER DISEASES OF THE RESPIRATORY SYSTEM AMONG TANNERS, COMPARED WITH THAT OF ALL OCCUPIED MALES IN ENGLAND AND WALES, 1900 TO 1902, BY AGE GROUPS.

[From Part II, Supplement to the Sixty-fifth Annual Report of the Registrar-General of Births, Deaths, and Marriages in England and Wales.]

Age at death.	Mortality from consumption.				Mortality from other diseases of the respiratory system.			
	Death rate per 1,000 for all occupied males.	Death rate for tanners.			Death rate per 1,000 for all occupied males.	Death rate for tanners.		
		Rate per 1,000.	Greater (+) or less (-) than rate for all occupied males.	Ratio to rate for all occupied males.		Rate per 1,000.	Greater (+) or less (-) than rate for all occupied males.	Ratio to rate for all occupied males.
15 to 19 years	0.54	1.12	+0.58	207	0.24	0.56	+0.32	233
20 to 24 years	1.55	1.26	— .29	81	.48	1.51	+1.03	315
25 to 34 years	2.03	1.13	— .90	56	.77	.43	— .34	56
35 to 44 years	2.74	.90	—1.84	33	1.66	1.62	— .04	98
45 to 54 years	3.04	4.17	+1.13	137	3.32	2.55	— .77	77
55 to 64 years	2.16	2.34	+ .18	108	6.54	8.60	+2.06	131
65 years and over	1.11	.....	.....	.....	17.77	16.03	—1.74	90

Curriers are considered separately from tanners in the English mortality statistics, and the mortality of this group of leather employees is somewhat higher than for tanners in the English experience.

Considering curriers as a separate occupation, including under this term leather goods makers generally, the report of the registrar-general on the occupation mortality of England and Wales for 1900 to 1902 contains the statement that—

Speaking generally, the death rates of curriers do not differ widely from those of all occupied and retired males, being slightly below the standard at ages 15 to 20 and 25 to 45, and above the standard at other ages. At ages under 20 the death rate of curriers is lower, and at ages 20 to 25 it is higher than that of tanners or furriers, but at ages above 25 the rates occupy an intermediate position between the two. In the main working period of life the comparative mortality figure is 1,015, or within 1 per cent of the standard for occupied and retired males generally, while it is 31 per cent above the corresponding figure for tanners, but 24 per cent below that for furriers. As with the ages at death, so with the causes of death, the mortality of curriers differs but little from the standard; they show, however, a slight excess of mortality from phthisis, Bright's disease, and suicide, but a low mortality from accident.^(a)

In the table which follows, the mortality from all causes among men in this group is compared with that of occupied males generally,

^a Part II, Supplement to the Sixty-fifth Annual Report of the Registrar-General of Births, Deaths, and Marriages in England and Wales, p. lxvi.

and it is shown that at the higher ages, 45 and over, the death rate of carriers is higher than for occupied males generally, but at ages under 45, except 20 to 24, the general death rate is somewhat lower for carriers than for occupied males generally.

MORTALITY FROM ALL CAUSES AMONG **CURRIERS**, COMPARED WITH THAT OF ALL OCCUPIED MALES IN ENGLAND AND WALES, 1900 TO 1902, BY AGE GROUPS.

[From Part II, Supplement to the Sixty-fifth Annual Report of the Registrar-General of Births, Deaths, and Marriages in England and Wales.]

Age at death.	Death rate per 1,000 for all occupied males.	Death rate for carriers.		
		Rate per 1,000.	Greater (+) or less (-) than rate for all occupied males.	Ratio to rate for all occupied males.
15 to 19 years.....	2.44	2.36	-0.08	97
20 to 24 years.....	4.41	5.24	+ .83	119
25 to 34 years.....	6.01	5.71	- .30	95
35 to 44 years.....	10.22	9.32	- .90	91
45 to 54 years.....	17.73	18.23	+ .50	103
55 to 64 years.....	31.01	34.95	+3.94	113
65 years and over	88.39	97.99	+9.60	111

A more extended analysis is made in the next table, in which the mortality of carriers from consumption and from other respiratory diseases is compared with the normal mortality of occupied males from these diseases by divisional periods of life. The comparison shows that the mortality from consumption is somewhat excessive at all ages except 25 to 34, and that the excess is most marked at ages 65 and over. As regards the mortality from respiratory diseases other than consumption, the differences are less marked, but at ages 55 to 64 the excess mortality was 2.04 per 1,000.

MORTALITY FROM CONSUMPTION AND FROM OTHER DISEASES OF THE RESPIRATORY SYSTEM AMONG **CURRIERS**, COMPARED WITH THAT OF ALL OCCUPIED MALES IN ENGLAND AND WALES, 1900 TO 1902, BY AGE GROUPS.

[From Part II, Supplement to the Sixty-fifth Annual Report of the Registrar-General of Births, Deaths, and Marriages in England and Wales.]

Age at death.	Mortality from consumption.				Mortality from other diseases of the respiratory system.			
	Death rate per 1,000 for all occupied males.	Death rate for carriers.			Death rate per 1,000 for all occupied males.	Death rate for carriers.		
		Rate per 1,000.	Greater (+) or less (-) than rate for all occupied males.	Ratio to rate for all occupied males.		Rate per 1,000.	Greater (+) or less (-) than rate for all occupied males.	Ratio to rate for all occupied males.
15 to 19 years....	0.54	0.92	+0.38	170	0.24	0.21	-0.03	88
20 to 24 years....	1.55	2.22	+ .67	143	.48	.40	- .08	83
25 to 34 years....	2.03	1.98	- .05	98	.77	.82	+ .05	106
35 to 44 years....	2.74	3.53	+ .79	129	1.66	1.43	- .23	86
45 to 54 years....	3.04	3.23	+ .19	106	3.32	3.75	+ .43	113
55 to 64 years....	2.16	2.91	+ .75	135	6.54	8.58	+2.04	131
65 years and over	1.11	2.19	+1.08	197	17.77	16.62	-1.15	94

The recorded industrial insurance mortality statistics of tanners, beamers, and curriers include 478 deaths from all causes, of which 89, or 18.6 per cent, were from consumption. Of the mortality of this group from respiratory diseases other than consumption, 65 deaths were from pneumonia, 9 from bronchitis, 5 from asthma, and 12 from less frequent respiratory diseases. If the deaths from consumption and from other respiratory diseases are combined, it is found that 37.6 per cent of the mortality of tanners, beamers, and curriers was from diseases of the lungs and air passages. The proportionate consumption mortality was excessive at all ages under 55. The excess in the mortality was most pronounced at ages 15 to 24, when out of every 100 deaths from all causes, 51.2 were from consumption, against a normal expected proportion of 27.8. The analysis in detail is set forth in the table following:

PROPORTIONATE MORTALITY FROM CONSUMPTION AMONG TANNERS, BEAMERS, AND CURRIERS, 1897 TO 1906, COMPARED WITH THAT OF ALL MALES IN THE REGISTRATION AREA OF THE UNITED STATES, 1900 TO 1906, BY AGE GROUPS.

[Figures for tanners, beamers, and curriers from experience of an industrial insurance company; figures for males in registration area computed from mortality statistics of the United States census.]

Age at death.	Deaths of tanners, beamers, and curriers, 1897 to 1906, due to—		Per cent of deaths due to consumption among—	
	All causes.	Consumption.	Tanners, beamers, and curriers.	Males in registration area, 1900 to 1906.
15 to 24 years.....	41	21	51.2	27.8
25 to 34 years.....	44	19	43.2	31.3
35 to 44 years.....	66	18	27.3	23.6
45 to 54 years.....	81	16	19.8	15.0
55 to 64 years.....	100	7	7.0	8.1
65 years and over.....	146	8	5.5	2.7
Total.....	478	89	18.6	14.8

The preceding observations and statistical data regarding curriers, and tanners, beamers, and curriers considered as a group, are more or less conflicting, but the insurance experience data fully confirm the conclusions regarding persons employed in the leather industry as a whole, that the mortality from consumption is excessive at all ages under 55, and that the excess is, in all probability, in part the result of more or less exposure to organic dust.

SADDLE AND HARNESS MAKERS.

In Rhode Island during the period 1852 to 1906 there were 153 deaths recorded of saddle and harness makers. Of this number 39, or 25.5 per cent, were from consumption, and 20, or 13.1 per cent, were from respiratory diseases other than consumption.

Regarding saddlers and harness makers, the report of the registrar-general on the occupation mortality of England and Wales for 1900 to 1902 contains the following:

At ages 15 to 20 years the death rate of saddlers is below the standard for occupied and retired males, but at all other stages of life the rates differ little from that standard. Within the main working period the comparative mortality figure is 945, or 6 per cent below the standard. The mortality from influenza, cancer, respiratory diseases, and accident is considerably below the average, but that from phthisis and from nervous diseases is slightly above it.^(a)

The most recent English mortality statistics for saddle and harness makers do not indicate that this particular branch of the leather industry is unfavorable to the life and health of the employees. In the table which follows, the mortality from all causes among men in this group is compared with that of occupied males generally, and the result is, on the whole, quite favorable to saddle and harness makers.

MORTALITY FROM ALL CAUSES AMONG **SADDLE AND HARNESS MAKERS**, COMPARED WITH THAT OF ALL OCCUPIED MALES IN ENGLAND AND WALES, 1900 TO 1902, BY AGE GROUPS.

[From Part II. Supplement to the Sixty-fifth Annual Report of the Registrar-General of Births, Deaths, and Marriages in England and Wales.]

Age at death.	Death rate per 1,000 for all occupied males.	Death rate for saddle and harness makers.		
		Rate per 1,000.	Greater (+) or less (-) than rate for all occupied males.	Ratio to rate for all occupied males.
15 to 19 years.....	2.44	1.81	-0.63	74
20 to 24 years.....	4.41	4.70	÷ .29	107
25 to 34 years.....	6.01	6.08	÷ .07	101
35 to 44 years.....	10.22	9.77	- .45	96
45 to 54 years.....	17.73	16.83	- .85	95
55 to 64 years.....	31.01	29.33	-1.68	95
65 years and over.....	88.89	90.33	÷1.94	102

A more extended comparison is made in the next table, in which the mortality of saddle and harness makers from consumption and from other respiratory diseases is compared with the normal mortality of occupied males from these diseases by divisional periods of life. The comparison shows that the mortality from consumption was somewhat excessive at all ages under 65, the excess being most pronounced at ages 20 to 24. On the other hand, it appears that the mortality of saddle and harness makers from respiratory diseases other than consumption was favorable at all ages when compared with the mortality for all occupied males. If the mortality from the two causes combined is taken, the mortality of saddle and harness

^a Part II, Supplement to the Sixty-fifth Annual Report of the Registrar-General of Births, Deaths, and Marriages in England and Wales, p. lx.

makers from consumption and from other respiratory diseases compares quite favorably with the mortality for all occupied males from the same diseases.

MORTALITY FROM CONSUMPTION AND FROM OTHER DISEASES OF THE RESPIRATORY SYSTEM AMONG **SADDLE AND HARNESS MAKERS**, COMPARED WITH THAT OF ALL OCCUPIED MALES IN ENGLAND AND WALES, 1900 TO 1902, BY AGE GROUPS.

[From Part II, Supplement to the Sixty-fifth Annual Report of the Registrar-General of Births, Deaths, and Marriages in England and Wales.]

Age at death.	Mortality from consumption.				Mortality from other diseases of the respiratory system.			
	Death rate per 1,000 for all occupied males.	Death rate for saddle and harness makers.			Death rate per 1,000 for all occupied males.	Death rate for saddle and harness makers.		
		Rate per 1,000.	Greater (+) or less (−) than rate for all occupied males.	Ratio to rate for all occupied males.		Rate per 1,000.	Greater (+) or less (−) than rate for all occupied males.	Ratio to rate for all occupied males.
15 to 19 years....	0.54	0.63	+0.09	117	0.24	0.18	−0.06	75
20 to 24 years....	1.55	2.84	+1.29	183	.48	.29	− .19	60
25 to 34 years....	2.03	2.58	+ .55	127	.77	.49	− .28	64
35 to 44 years....	2.74	3.49	+ .75	127	1.66	1.19	− .47	72
45 to 54 years....	3.04	3.56	+ .52	117	3.32	2.01	−1.31	61
55 to 64 years....	2.16	2.24	+ .08	104	6.54	5.39	−1.15	82
65 years and over	1.11	.60	− .51	54	17.77	14.45	−3.32	81

For the purpose of making this statistical statement as complete as possible, the following table for Switzerland is added. The table shows the mortality from consumption among saddlers, compared with that for all occupied males in Switzerland. This table indicates that the mortality from consumption among saddlers in Switzerland was in excess of that for all occupied males at all ages except 40 to 49, the excess being greatest at ages 60 to 69, when it equaled 6.76 per 1,000. This unfavorable experience may be due to the different methods of manufacture in Switzerland as compared with England and the United States.

MORTALITY FROM CONSUMPTION AMONG **SADDLERS**, COMPARED WITH ALL OCCUPIED MALES IN SWITZERLAND, 1879 TO 1890, BY AGE GROUPS.

[Figures from Vital Statistics of Switzerland, 1871 to 1890, Part III.]

Age at death.	Death rate per 1,000 for all occupied males.	Death rate for saddlers.		
		Rate per 1,000.	Greater (+) or less (−) than rate for all occupied males.	Ratio to rate for all occupied males.
15 to 19 years.....	1.30	2.10	+0.80	162
20 to 29 years.....	3.04	4.24	+1.20	139
30 to 39 years.....	3.66	6.77	+3.11	185
40 to 49 years.....	3.65	3.61	− .04	99
50 to 59 years.....	3.52	6.83	+3.31	194
60 to 69 years.....	3.25	10.01	+6.76	308
70 years and over	1.84	4.33	+2.49	235

The recorded industrial insurance mortality statistics include 510 deaths of harness makers and saddlers from all causes, of which 89, or 17.5 per cent, were from consumption. Of the mortality of harness makers and saddlers from respiratory diseases other than consumption, 41 deaths were from pneumonia, 9 from bronchitis, 4 from asthma, and 7 from less frequent respiratory diseases. If the deaths from consumption and from other respiratory diseases are combined it is found that 29.4 per cent of the mortality of harness makers and saddlers was from diseases of the lungs and air passages. The excess in the consumption mortality is brought out clearly in the tabular presentation of the proportionate mortality from this disease by divisional periods of life. The proportionate consumption mortality was excessive at all ages under 65, but the excess was most pronounced at ages 25 to 34, when out of every 100 deaths from all causes 47.7 were from consumption, against a normal proportionate mortality of 31.3. The analysis of the consumption mortality of harness makers and saddlers is set forth in detail in the table following:

PROPORTIONATE MORTALITY FROM CONSUMPTION AMONG HARNESS MAKERS AND SADDLERS, 1897 TO 1906, COMPARED WITH THAT FOR ALL MALES IN THE REGISTRATION AREA OF THE UNITED STATES, 1900 TO 1906, BY AGE GROUPS.

[Figures for harness makers and saddlers from experience of an industrial insurance company; figures for males in registration area computed from mortality statistics of the United States census.]

Age at death.	Deaths of harness makers and saddlers, 1897 to 1906, due to—		Percent of deaths due to consumption among—	
	All causes.	Consumption.	Harness makers and saddlers.	Males in registration area, 1900 to 1906.
15 to 24 years.....	34	15	44.1	27.8
25 to 34 years.....	44	21	47.7	31.3
35 to 44 years.....	60	20	33.3	23.6
45 to 54 years.....	86	20	23.3	15.0
55 to 64 years.....	131	11	8.4	8.1
65 years and over.....	155	2	1.3	2.7
Total.....	510	89	17.5	14.8

The preceding observations and statistical data indicate that in certain branches of the leather industry the inhalation of dust undoubtedly tends to shorten the lives of the employees and to cause a somewhat excessive mortality from consumption and from other respiratory diseases. These unfavorable conditions, however, appear to be more frequently met with in the working of finished leather than in the tanning processes. Taking the leather industry as a whole, the unfavorable effects of dust inhalation are less pronounced than in most other dusty trades.

GLOVE MAKING.

The glove industry in 1900 gave employment to 14,436 wage-earners, of which 9,754 were women. During the preceding decade the number of wage-earners increased 76.3 per cent, but the number of women wage-earners considered separately increased 91.6 per cent. These are the census returns for 1900, which, however, are limited to gloves and mittens made of leather, but the number employed in the manufacture of gloves and mittens of other materials is not accurately known. The process of manufacture has been described in the census report on manufactures in part as follows:

As soon as the skin is received by the glove maker it is immediately staked by the hand stake, which consists of two upright and two horizontal bars, one of the latter being movable to admit the skin, which is held in position by a wedge inserted at the end of the bar. The stretching is then done by pressing over the skin so placed a blunt iron, like a spade, having round corners and a handle which fits under the arm. The oil-dressed skins are then split even in a belt-splitting machine, and the kid skins are shaved either by "moon-ing" or by placing them on a marble slab with the flesh side up, and shaving the surface with a broad chisel or so-called "dowling" knife. By this process the skin is reduced to the desired thinness, and the inequalities of the flesh side are removed. "Mooning" is done with a round steel shaped like a plate and having the center cut out and a handle placed across the opening; the skin is then hung on an elastic pole and the moon-shaped knife is drawn over the flesh until the desired result is secured. The skin is then ready to go to the cutters, of which there are two classes, the block and the table cutter, each class, as a rule, having separate rooms. The block cutters, most of whom are of American parentage, are engaged in cutting the cheaper and coarser grade of gloves.

The skin is placed on a block made of hard-wood planks placed on end and bolted together, and the die of the required shape and style is placed carefully on the skin and given a blow with the maul. In the table-cutter's room tables instead of blocks are used. The skin is dampened, then stretched over the end of the table until it will stretch no more, and then cut off the length of the glove; next stretched to width and cut off, after which the fingers and opening are put in with the die and press.

From the cutters' room the leather, which has assumed the shape of the glove, is sent to the "silkers," who embroider the back, and then to the "makers." Some make the gloves—that is, they sew the fingers and put the thumbs in; others, called "welers," are engaged in welting or hemming the glove around the edge at the wrist; still others, called "pointers," work the ornamental lines on the back.

After the glove has reached this stage of completion, the fourchettes and the thumb are put in place; the back is then embroidered and the end of the silk is pulled out and tied, and the glove closed by beginning either at the upper end of the long seam and sewing

toward the little finger, or at the end of the index finger and finishing with the long seam. The glove is now ready to be bound, hemmed, or banded, the buttonhole made, or the lacings or fastener adjusted. After the gloves are made they are drawn over metal hands heated by steam, a "laying-off" process, as it is termed, and by means of which the glove is shaped and given its finished appearance. The gloves are now ready for inspection, and are assorted according to grades and sizes, and finally forwarded to the stock room, ready for shipment.^(a)

The foregoing descriptive account of the usual method of manufacture does not indicate any particularly unfavorable conditions detrimental to health. As far back, however, as 1860, the sanitary aspects of the employment attracted attention, and in the Third Report of the Medical Officer of the Privy Council, published in 1861, extended consideration was given to the manufacture of gloves in the registration district of Yeovil, England, where at that time nearly one-third of the women were engaged in glove manufacture, then regarded as the staple business of the district. The manufacture of gloves was at that time almost entirely a domestic industry, although there were some factories where the materials were cut out and partly made up. Approximately 50,000 persons were employed in this branch of domestic manufacture, and the industry attracted the attention of the sanitary authorities on account of the high general death rate from pulmonary diseases. While the women were chiefly employed at home, the men engaged in the glove trade were for the most part at work in the factories, where a few children and young women were employed at the time. Boys were employed as early as 7 years of age; and the hours were from 6 a. m. to 8 p. m., with a reasonable time for meals. The workrooms in some of the factories were low and the ventilation was very imperfect. In commenting upon the health of the working people the report states that—

Except from working in ill-ventilated rooms for so many hours a day, there is no ostensible reason why persons employed in the glove factories should suffer in an unusual degree from pulmonary diseases. Drinking is said to be a common vice among the men, many of whom pass the first two days of the week in dissipation, and work very hard during the remainder, to recover lost time. On this account men sometimes work as long as seventeen or eighteen hours out of the twenty-four toward the end of the week. It was asserted that, though still dissipated and improvident, the character of the men has much improved during the last twenty years.^(b)

^a Report on Manufactures, Part III, Twelfth Census of the United States, 1900, p. 797.

^b Third Report of the Medical Officer of the Privy Council, 1861, pp. 189, 190.

After an extended account of the decidedly unfavorable conditions of work affecting women and children employed in the industry, the report concludes with the statement that—

As far as could be ascertained, the great prevalence of pulmonary diseases among the population of Yeovil, as shown by the excess of mortality above the normal rate, is caused mainly by the sedentary habits of the people; by the small, imperfectly ventilated, and often overcrowded cottages in which they dwell; and, in the case of the men, and of a small proportion of females and children, by the close ill-ventilated factory rooms in which they work.^(a)

In a subsequent report of the medical officer of the Privy Council for the year 1863, published in 1864, the sanitary aspects of the glove industry were again considered at some length, chiefly, however, with reference to the employment of kid-glove stitchers. It is pointed out in the report that in this employment "The position of the body is that of sitting and leaning forward; and as close attention is required, and much work has to be performed by a most inefficient artificial light, the stitcher stoops, and places her eyes very near to her work. Hence contraction of the chest, displacement of the lungs backward, deficient respiration, and impaired eyesight commonly follow." To these evils are added those of long hours, low wages, and the employment of children between the ages of 9 and 14 years. "The general state of health was not good, the women and children were commonly pale, and had thin, sensitive skins, and when they were not emaciated they were weak." The inquiry into the employment included a careful consideration of the food, and the final conclusions were summed up in the statement that: (1) The occupation was an unrequited and unhealthful one, certain to produce unfavorable results upon the body, mind, and morals of female children and upon the women generally; (2) that the working people were ill fed and unhealthy; and (3) that the money expended upon food did not obtain the amount of nourishment which it might obtain.^(b)

In the same report there is an account of the sanitary aspects of stocking and glove weavers, which, however, for practical purposes, may be considered as a branch of the knitting and hosiery industry. The conclusions of the inquiry with respect to this class of labor were somewhat more favorable, but they also appear to warrant the opinion that the state of health was below the normal, chiefly, however, because of low wages and poor housing accommodations.

Glove making is considered at some length by Arlidge, who observes that the industry has no serious incidental health factors, and that it is not, in so far as the majority of male workers are concerned,

^a Third Report of the Medical Officer of the Privy Council, 1861, pp. 189, 190.

^b Sixth Report of the Medical Officer of the Privy Council, 1864, pp. 225-227.

in a strict sense a sedentary occupation, for several kinds of work call for active movements of both the arms and trunk and a standing position; but in the case of women, he remarks, and chiefly in the finishing branches, the sitting posture is the rule. He remarks further that—

The skins used by glovers are received from the skin-dressers in a dry parchment-like condition, and besprinkled with a fair amount of dust. In sorting the skins before delivery to the glove makers, considerable dust, of an irritating character, is thrown off. By a succeeding operation, called "frizzing," effected by drawing and stretching the skin over a steel edge, the stiffness is removed. This done, the next process is to reduce the thickness by a kind of shaving process, and to trim its rough and irregular edges. To reduce thickness the skin is stretched on a marble or metal slab, and being dusted with flour, is shaved on its under or flesh side by a broad chisel-like implement. While thus engaged, the workman frequently blows away the soft fibrous trimmings with his mouth, and from time to time resprinkles the surface with flour. Large coarser skins are stretched on a sort of wooden shield, "the beam," and worked with a two-handled tool, which the workman draws toward him. This proceeding creates a risk of severe wounds above the knee, should the leather tear. The operation is called "doling," and is admitted by the men engaged in it to be unhealthy; causing tightness and weight at the sternum, and after some years' employment, chronic bronchitis and asthma.^(a)

The most recent authority on the sanitary aspects of the industry is a small treatise in German entitled *Health Book of Glove Manufacture*, by Dr. Alfred Mode, published in 1899. The hygienic aspects of glove manufacture and resulting diseases are considered in detail, but confirming more or less the observations and conclusions of earlier authorities. Doctor Mode calls attention to the comparatively high degree of consumption frequency in the industry, but he in part attributes this to the fact that the labor being light persons predisposed to the disease are attracted to the employment. He remarks that dust is generated in quite large quantities in some of the processes, but not in all, and that there is unquestionably a direct relation between dust and disease in the glove-making industry. But conceding this to be the case, he concludes that it is very difficult indeed to state with accuracy how far each of the various factors detrimental to health is chiefly responsible for the disease, for aside from dust it is necessary to consider the unfavorable bodily position assumed in some of the occupations, the effect of polluted atmosphere, high temperature in some of the rooms, and a generally irrational mode of life. Tuberculosis, he states, is met with in all its various forms among glove makers, chiefly, of course, as consumption of the lungs. Bronchitis, pneumonia, and influenza are also stated to be of more than

^a *Diseases of Occupations*, by J. T. Arlidge, p. 211.

normal frequency, but how far the occurrence of these diseases is favored by insanitary habits on the one hand and alcoholism on the other it is difficult to say. Among the women employed anæmia and chlorosis, as well as consumption, are exceedingly common. Doctor Mode quotes the statistics of the Communal Insurance Institution for Glove Makers, including 500 members, among whom there occurred 127 cases of sickness, of which about 25 per cent were diseases of the lungs and air passages. While the statistical material considered is too limited for definite conclusions, it confirms the opinion based upon general considerations that the dust factor in glove making accounts in part at least for a comparatively high mortality from consumption in this employment.

BOOT AND SHOE MAKERS.

The number of persons in the United States employed in boot and shoe making, including repairing, as shown by the report of the census of 1900 on occupations, was 209,047, including 39,510 women. Of the total, 106,819 were boot and shoe factory operatives, 101,643 were shoemakers not in factories, while 585 were apprentices. Of the factory operatives 37,478, or 35.1 per cent, were women.^(a) The tendency in the industry is steadily toward the elimination of the handmade product, and the shoemakers who are not factory operatives are practically all engaged in repair work. The modern methods of boot and shoe manufacture are extremely intricate industrial processes and practically every operation is more or less mechanical. Most of the processes of manufacture as such have, apparently, no immediate relation to the health of the operative, and a descriptive account of the industry is therefore unnecessary. The newer shoe factories are large establishments, well ventilated, and properly provided with light and sanitary accommodations. On account of the far-reaching changes in the industry from hand work to machinery, the earlier observations upon the health and mortality of boot and shoe makers apply only in part to the trade at the present time and almost exclusively to the men engaged in repair work. Thackrah observes that shoemakers, on account of their employment, are required to assume a very unfavorable position, as the result of which the abdominal viscera, and especially the stomach and liver, are compressed. He holds further that "digestion and circulation are so much impaired, that the countenance would mark a shoemaker almost as well as a tailor." The same writer had ascertained that the capacity of the lungs in the case of shoemakers is found to average 182 cubic inches, and the circumference of the chest 35 inches. In the case of the few shoemakers observed who lived to old age, it was

^a Report on Occupations, Twelfth Census of the United States, 1900, p. 8.

found that there was often "a remarkable hollow at the base of the breastbone, occasioned by the pressure of the last." While the position and other conditions of the employment of the shoemaker were, no doubt, injurious to health, bad habits, in the opinion of Thackrah, were much more responsible for the high mortality observed at the time.^(a)

Writers on industrial diseases subsequent to Thackrah comment upon the favorable influence of the introduction of machinery into the trade, not only removing certain health-injurious consequences of shoemaking by hand, but also resulting in the building of larger and better lighted and ventilated workshops. Doctor Arlidge was one of the first of English authorities on occupation diseases to give extended consideration to the hygiene of the employment under more modern conditions. From this writer is quoted the following statement:

In the circumstances prevailing less than half a century ago, there was much to write about respecting the business of boot and shoe makers in its relation to health. The greater portion of the work was then done by the solitary shoemaker, or by a few collected in a small shop; and the whole operation was a simple handicraft. At the present time the old-fashioned craftsman is rapidly disappearing under the influence of factories, often of large dimensions, fitted with machinery which requires little else than the guiding hand, and turns out boots and shoes in as few minutes as the best workmen in olden time took hours to accomplish.

In the olden time the shoemaker sat with his last held firmly between his thighs and knees, and to "close" used a simple instrument, the clamp, to keep approximated the edges to be sewed together. He sat on a low stool, with the trunk bent forward considerably, the last pressing against his breast-bone and stomach. With his awl he drilled holes to pass his waxed thread through, using his arms forcibly to fasten each stitch. To fix the sole on the uppers the drilling and stitching demanded vigorous pulling by an outward movement of the arms from the chest, not unfavorable to chest expansion. But the advantages of this expansive movement were negated by the pressure of the last against the chest, which, when practiced from early years, caused a marked depression of the breast-bone and cartilaginous ends of the ribs, in outline like the hollow of a spoon. This pressure was, at the same time, detrimental to the stomach, and a cause of dyspepsia. The long sitting had as its sequel obstinate constipation, doubtless aggravated by neglect of the workmen.

In the modern style of bootmaking the uppers are riveted to the soles, instead of being stitched. Where "making" is done at home by hand, the chest suffers from pressure against it of the heel of the boot, fixed on an iron last, in the operation of burnishing and filing off the rough ends. Those who cut out and shape the leather to be

^a Effects of Arts, Trades, and Professions on Health and Longevity, by C. Turner Thackrah, 1832, p. 30.

made up are called "clickers;" and these pursue their work standing in a stooping attitude, and to some extent press the stomach against the workbench. For the finishing operation upright lasts have been introduced, at which the men can stand; but many prefer, as of old, sitting, with more or less pressure of the last against the thorax.^(a)

Referring to the earlier observations by Thackrah, Doctor Arlidge remarks that the health-injurious circumstances of the employment, as then observed, were probably more the result of insanitary shops, dirt, and irregular living than because of any peculiarities of trade processes. Nevertheless, he remarks, however, "even at the present period, the bulk of shoemakers have a meager, unhealthy look (though working in capacious factories and rescued by machinery from what were unhealthy mechanical operations), due, principally, to the fact that many of them still pursue the evil example of their forefathers, in addiction to strong drinks, besides many irregularities damaging to health."

With special reference to phthisis, Arlidge refers to the recorded mortality of shoemakers in Copenhagen, where, according to Hannover, it had been calculated that one-third who followed the trade died from this disease. Referring to Doctor Ogle's more recent English data, it appeared that out of 1,635 deaths of shoemakers from all causes 451, or 27.6 per cent, were from phthisis, certainly, in the opinion of Arlidge, "an excessively high ratio." The remarks by Arlidge conclude with the following statement:

The vital statistics of shoemakers, as above quoted, apply, to a great extent, to past years, when the old trade operations were in vogue. It will be interesting to learn what changes for the better the adoption of machines and the extension of the factory system to the trade have wrought in the health history of shoemakers. The new system has evidently numerous advantages, but these may, in some degree perhaps, be lessened by the circumstances of associated labor, and of heated and overlighted workrooms, particularly where hot pipes exist, and a superabundant supply of gas is consumed.^(b)

Among the more recent authorities on the health-injurious circumstances of boot and shoe making reference may be made to Doctor Oliver's article in his treatise on Dangerous Trades, in which there is included an illustration of one of Doctor Oliver's own patients in the Newcastle Infirmary, exhibiting a case of shoemaker's chest, showing the great recession of the lower part of the chest, due to the pressure of the last. In describing the conditions which led to this deformity, which has an important bearing upon the degree of consumption frequency among men in this trade, Oliver, after ex-

^a Diseases of Occupations, by J. T. Arlidge, pp. 215, 216.

^b Idem, p. 217.

pressing the opinion that in course of time this affliction would probably cease to exist, remarks that—

At his work the old type of shoemaker would sit on a low bench, with his thighs and knees tightly drawn towards each other, clasping the last with the boot upon it. His trunk would be bent down over his work, so that during the act of stitching and drawing the waxen threads through the holes made by his awl in the leather, his arms would be forcibly separated from his sides in order to tighten each stitch, while any beneficial expansion of the chest that this movement created was unfavorably counterbalanced by the increased pressure of the last upon his chest bone. As a consequence of this repeated pressure applied to the front of the chest, especially on younger men, the chest bone and ribs were driven in so as to form a deep hollow.^(a)

The same authority on occupation diseases observes, with respect to present-day conditions affecting health and life in the boot and shoe industry, that—

Shoemakers formerly suffered from bronchitis and pulmonary phthisis in fairly large numbers, but much of this was due to the sedentary character of their occupation, their want of exercise in the open air, and their intemperate habits. The introduction of machinery, and the bringing of shoemaking under the factory acts, may to some extent effect an improvement in the health of shoemakers, but in many of the factories which I have visited, and where large numbers of persons are employed, the overheated rooms in which the work is carried on and the vitiated atmosphere rather predispose the workpeople to pulmonary catarrh, and tend to make the women anæmic. In addition, mercurial poisoning has been known to occur in the men employed in shoemaking factories, whose duty it is to mind the American or Blake machines. The mercury is placed in a well in the machine, to act as a lubricant, and as the metal is extremely volatile, poisoning may readily arise.^(a)

The liability of boot and shoe makers to industrial phthisis was inquired into by the British departmental committee on compensation for industrial diseases. Dr. J. Beatty, medical officer of health of Northampton gave evidence to the effect that the mortality from phthisis among boot and shoe makers was excessive, but he was not of the opinion that the form of the disease was of the fibroid type, but, to the contrary, held that the disease, as generally met with among men in this employment, was tubercular phthisis in its usual form. He said that the death rate of shoemakers, undoubtedly, was above the average and that it was higher among male operatives than among female operatives. According to his calculations, the phthisis death rate for boot and shoe makers was 2.59 per 1,000, against a normal average of 2.08 for the whole population. Referring to the finishing process as an exceptionally dusty one, and one in which the con-

^a Dangerous Trades, by Thomas Oliver, p. 824.

ditions predisposing to consumption were, apparently, most in evidence, he stated that—

In the finishing process they put the sole of the boot over an emery or glasspaper wheel, and rub off a great deal of dust from it, with, of course, a certain amount of brass filings from the rivets. In that case, of course, there is a good deal of dust produced, which is taken away by fans; but nevertheless a certain amount gets into the throats of the workmen. If I found that in a factory concerned the dust was not properly taken off and the men developed phthisis, and I could not find any other cause for it, I should be disposed to say that in that case probably the disease had originated from the man's employment, or that his lungs had been so weakened that he was rendered liable to it.^(a)

Aside from exceptional circumstances in the case of particular branches of the industry, on the whole the conclusions of Doctor Beatty conform to the opinion of Doctor Tatham, based upon the observed mortality of shoemakers generally, and expressed in the statement that—

Although the contrary is generally held to be the fact, shoemakers are shown, by the figures now at our disposal, to enjoy a degree of health which is at least equal to that of the average workingman.^(a)

What in England is called "clicking," that is, the cutting of the leather to a pattern, is generally considered to be more unhealthy than most of the other branches in the boot and shoe industry. Doctor Beatty, in his evidence as to why men in this employment were exceptionally liable to lung diseases, said that clickers in their work had to stoop a great deal, which, of course, would tend to act on the chest and diminish its capacity, but clicking was also supposed to attract the physically weak, who were unfit for branches of the trade requiring a healthier and more robust type.

Much additional evidence was submitted to the committee on compensation for industrial diseases, but no conclusive evidence was produced to prove either an excessive death rate or particularly unhealthy conditions predisposing to a high mortality from consumption. More definite and conclusive are the results of an investigation made by the Massachusetts state board of health, published in 1905 and in 1907. In the first report, which was published in the Thirty-sixth Annual Report of the State Board of Health of Massachusetts, it is stated that some thirty different boot and shoe making establishments had been investigated and that nearly all of them had been found to be provided, to some extent, with blower or exhaust fans, for mechanical ventilation, but that in many instances the apparatus was inadequate for the needs of the establishment. In certain processes connected with the manufacture of shoes, it was found that considerable dust was

^a Report of the Departmental Committee on Compensation for Industrial Diseases, Minutes of Evidence, p. 277. London, 1907.

produced, and as a result, it was held, the industry should be classed among the dusty trades. Reference is made to the mortality returns of Lynn and Brockton, which are the two most important centers of the boot and shoe industry in Massachusetts. In the city of Brockton out of 167 deaths occurring among shoemakers, 42, or 25.1 per cent of the whole, were found to be due to pulmonary consumption, and of this number the proportion of those dying below the age of 30 was 36 per cent. The number of deaths from all lung diseases, including consumption, was 61, or 36.5 per cent of the mortality from all causes. In Lynn during a period of three years there occurred 297 deaths among shoemakers, 65, or 21.9 per cent, of which were due to consumption. Including deaths from other respiratory diseases, the total mortality from diseases of the lungs and air passages was 95, or 32.0 per cent of the mortality from all causes. More than one-half, or 55.4 per cent, of those who died from consumption had not yet attained their thirtieth year. The report concludes with the statement that—

There was one condition which was very noticeable in a large proportion of the shoe factories visited, but by no means peculiar to this line of industry, and that was the habit of indiscriminate spitting. In some instances spittoons were provided, and these appeared to diminish the habit of spitting carelessly upon the floors; in some, spitting is forbidden; in others, it is not forbidden and spittoons are not supplied. In some of the larger establishments everything that can be provided for the health, comfort, and happiness of the employees may be found; but in others there is room for very marked improvement.^(a)

The report published in 1907 considers the industry at greater length, including an examination of the conditions observed by personal inspection in 373 establishments. Of these 62 were found to be with good conditions regarding the health and welfare of the working people, 91 with unsatisfactory conditions, 72 with poor conditions, 19 with distinctly bad conditions, and 129 were unclassified. The report points out that four conditions had been observed to prevail, all of which were subject to ventilation changes, being, first, poor ventilation; second, inadequate removal of dust from machines; third, the condition of toilet rooms; and fourth, spitting upon the floors. In the majority of the factories visited the ventilation was found to be poor, and in many of them distinctly bad. In the rooms in which large amounts of dust were evolved, the number of machines with means for efficient, or fairly efficient, removal of dust, was found to be 1,630, while the number either inefficiently equipped, or void of equipment, was 2,769. Of 84 of the many dusty rooms reported, 40 were

^a Thirty-sixth Annual Report of the State Board of Health of Massachusetts, for the year ending September 30, 1904, pp. xxvi, xxvii.

also overcrowded, 35 were dark, 21 were overheated, and 18 were overcrowded, dark, and overheated. In the opinion of the inspectors of the state board of health, the health of the employees in the industry in the larger number of establishments appeared to be from fair to good, but in 85 factories, or 23 per cent of those visited, a considerable proportion of the employees were noticeably pale and unhealthy.

With respect to ventilation it is stated that—

In the majority of the factories visited the ventilation was found to be poor, or distinctly bad; and in most cases where these conditions obtained, there was excessive heat. Where the ventilation is poor, the air becomes much worse toward night; and in some cases it is so bad that the employees assert that they are sometimes nauseated on entering the workrooms in the morning. These are usually long and narrow; and if, in cold weather, the windows are opened, cross-drafts are established. Some foremen say that, while they would be blamed were employees to complain that they had taken cold from open windows, they are not blamed by employees for sickness due to vitiated air and overheating. Crowding of rooms with machinery and stock facilitates work by shortening the distances through which the shoes have to travel in the processes of manufacture; and it is asserted that more cubic space per capita would involve a considerable addition to the general expense of maintenance.

In 103 factories strong odors of naphtha were observed. In some establishments it was said that the odors were so overpowering that the girls who handle the naphtha cement become nauseated, and suffer from headache. Some of the naphtha cements cause much more trouble than others. In 24 factories fumes of wood alcohol were plainly observable.

In a certain number of rooms strong odors of naphtha were noticed, in addition to wood alcohol fumes. In 74 of the many unventilated rooms, some of which were overcrowded and overheated, the employees were exposed to strong fumes of naphtha or of wood alcohol, or of both. As stated elsewhere in this report, wood alcohol fumes are a real danger to health, and especially to sight, not infrequently causing total blindness; but no instances of trouble arising therefrom were reported in the investigation of this industry.^(a)

Regarding the removal of dust, the report states, in part, as follows:

The rooms in which large amounts of dust are evolved are those in which the operations of heel trimming, edge trimming, buffing, naumkeaging, heel scouring, breast scouring, polishing and upper cleaning are conducted. For effective removal of this dust, exhaust flues attached to the machinery are necessary. Of the 373 factories visited, 126 are partially, and a fair proportion of these are wholly, equipped with this means of protection to the workmen; in 88 of these 126 one or more machines are not so equipped; and in 49 of the 88 there are rooms in which the air, apart from the escaping dust,

^a Report of the Massachusetts State Board of Health upon the Sanitary Condition of Factories, Workshops, etc., 1907, p. 58.

is noticeably bad. The number of machines with means for efficient or fairly efficient removal of dust was found to be 1,630; the number either inefficiently equipped or devoid of equipment was reported as 2,769.

The reasons for inefficiency include improper adjustment of hoods, clogging of pipes, leaking pipes, bad connections, poor draft, small openings, small pipes, improper position of machines with reference to light, necessitating the raising of hoods in order to see well. It appears, however, that a machine may be fairly effective in dust removal with one kind of work, and faulty with another; and that, while with some kinds of material a well-equipped machine may give off some dust, with other material a machine without exhaust drafts may create little, if any. Again, in edge trimming much less dust is produced when light and thin-soled shoes are made; and, further, it not infrequently happens that, owing to changes in styles of shoes, it becomes necessary to introduce machines into places where such were not originally intended to go, or processes are modified so that machines which worked unobjectionably before give off much dust when employed on a different kind of material. Thus it happens that in certain factories, in which there is an evident intention to have all conditions perfect, a set of machines may be found whose running is attended by objectionable conditions. It is only fair to state that in one city (Marlborough) nearly all of the factories have unusually good dust-removing machinery, and that the results are generally most commendable. Of 84 of the many unventilated and dusty rooms reported in the course of this investigation, 40 were overcrowded, 35 were dark, 21 were overheated; and 18 were overcrowded, dark and overheated.^(a)

The report includes extracts from the reports upon individual establishments, from which, for purposes of illustration, the following quotations are made:

About one-tenth of the employees seem to be in poor health. Several weak-looking boys exposed to strong odors of wood alcohol. Room with 60 occupants, crowded with stock, air bad, and strong odor of naphtha in various parts. Room with 75 occupants, overcrowded, overheated, unventilated. Room with 50 occupants, crowded with stock and machinery, air foul and dusty.

Room with 50 occupants, several under 18 years of age, very hot and air very foul. Much spitting on the floor. Some of the machines give off a great deal of fine dust. More than half of the cubic space in this room is taken up by stock and machinery.

Room with 120 occupants, exposed to much fine dust; 20 men exposed to strong fumes of naphtha and wood alcohol. Some of them are noticeably pale, but all of them have become accustomed to the smell. Another room, with 120 occupants, overheated and not ventilated. Much spitting on the floor. Some of the women and about one-half of the minors of both sexes look pale and poorly nourished.

Rooms occupied by from 40 to 160 persons, are overcrowded and not ventilated. In some the odor of naphtha is strong; in some the

^a Report of the Massachusetts State Board of Health upon the Sanitary Condition of Factories, Workshops, etc., 1907, p. 59.

dust is excessive. In one, with 40 occupants, a cloud of fine dust flies from 11 scouring machines and settles upon the walls and wherever it can reach, and men complain of great discomfort therefrom. Half of the men look unhealthy. From 9 rotary brushes a great deal of fine black dust and lint is thrown, and it settles everywhere, including the faces and especially about the nostrils of the workmen. All of the men in this room, and 3 boys aged about 16, appear to be in especially poor health.^(a)

The census mortality statistics of boot and shoe makers by divisional periods of life are compared in the following table with the similar data for the manufacturing and mechanical and the mercantile and trading classes.

MORTALITY FROM ALL CAUSES AMONG **BOOT AND SHOE MAKERS**, COMPARED WITH THAT OF THE MANUFACTURING AND MECHANICAL CLASS AND THE MERCANTILE AND TRADING CLASS, IN THE REGISTRATION STATES, 1900, BY AGE GROUPS.

[From report on Vital Statistics, Twelfth Census of the United States, 1900.]

Age at death.	Death rate per 1,000 among—		
	Boot and shoe makers.	The manu- facturing and mechan- ical class.	The mer- cantile and trading class.
15 to 24 years	2.74	4.43	2.60
25 to 44 years	3.39	8.35	6.72
45 to 64 years	11.18	20.16	19.91
65 years and over.....	77.87	105.43	93.79

According to this table the general death rate of boot and shoe makers compares favorably with the other classes at all of the specified ages.

Opposed to this favorable general death rate there is other statistical evidence that boot and shoe makers are subject to a comparatively high mortality from consumption. In Rhode Island, during the period 1852 to 1906, there were 716 deaths reported of shoemakers, 138, or 19.3 per cent, of which were from consumption, and 64, or 8.9 per cent, from other respiratory diseases.

Regarding shoemakers, the report of the registrar-general on the occupation mortality of England and Wales for 1900 to 1902 contains the following decidedly suggestive observations based upon the observed mortality of 197,555 shoemakers above the age of 15 years:

It appears that up to the age of 35 years, and again at ages above 65 the mortality of shoemakers slightly exceeds the standard for all occupied and retired males, while at other ages it is slightly below that standard. Within the main working period of life the compara-

^a Report of the Massachusetts State Board of Health upon the Sanitary Condition of Factories, Workshops, etc., 1907, pp. 61-63.

tive mortality figure is 984, or within 2 per cent of the average; the mortality from phthisis, however, is in excess by 45 per cent, but that from influenza and respiratory diseases, as well as from alcoholism and liver disease, and Bright's disease, is considerably below the standard, and the mortality from accident is little more than one-third of the average.^(a)

The most recent English mortality statistics are also suggestive of health-injurious conditions in this trade. In the table which follows the mortality from all causes among men in this employment is compared with that of occupied males generally. The general death rate is somewhat excessive at ages under 35, but is favorable at ages 35 and over.

MORTALITY FROM ALL CAUSES AMONG **BOOT AND SHOE MAKERS**, COMPARED WITH THAT OF ALL OCCUPIED MALES IN ENGLAND AND WALES, 1900 TO 1902, BY AGE GROUPS.

[From Part II, Supplement to the Sixty-fifth Annual Report of the Registrar-General of Berths, Deaths, and Marriages in England and Wales.]

Age at death.	Death rate per 1,000 for all occupied males.	Death rate for boot and shoe makers.		
		Rate per 1,000.	Greater (+) or less (−) than rate for all occupied males.	Ratio to rate for all occupied males.
15 to 19 years.....	2.44	2.65	+0.21	109
20 to 24 years.....	4.41	5.14	+ .73	117
25 to 34 years.....	6.01	6.33	+ .32	105
35 to 44 years.....	10.22	9.82	− .40	96
45 to 54 years.....	17.73	17.37	− .36	98
55 to 64 years.....	31.01	29.14	−1.87	94
65 years and over	88.39	83.13	−5.26	94

A more extended comparison is made in the next table in which the mortality of boot and shoe makers from consumption and other respiratory diseases is compared with the normal mortality of occupied males from these diseases, by divisional periods of life. The comparison shows that at all ages the mortality of boot and shoe makers from consumption is excessive by from 0.41 to 1.50 per 1,000. The excess was most marked at ages 35 to 44, but it was considerable at ages 20 to 54. The corresponding mortality from other respiratory diseases among boot and shoe makers was slightly favorable at all ages by from 0.02 to 1.00 per 1,000. The slightly favorable mortality from other respiratory diseases does not, however, balance the excess mortality from consumption.

^aPart II, Supplement to the Sixty-fifth Annual Report of the Registrar-General of Births, Deaths, and Marriages in England and Wales, p. lxiii.

MORTALITY FROM CONSUMPTION AND FROM OTHER DISEASES OF THE RESPIRATORY SYSTEM AMONG **SHOEMAKERS**, COMPARED WITH THAT OF ALL OCCUPIED MALES IN ENGLAND AND WALES, 1900 TO 1902, BY AGE GROUPS.

[From Part II, Supplement to the Sixty-fifth Annual Report of the Registrar-General of Births, Deaths, and Marriages in England and Wales.]

Age at death.	Mortality from consumption.				Mortality from other diseases of the respiratory system.			
	Death rate per 1,000 for all occupied males.	Death rate for shoemakers.			Death rate per 1,000 for all occupied males.	Death rate for shoemakers.		
		Rate per 1,000.	Greater (+) or less (−) than rate for all occupied males.	Ratio to rate for all occupied males.		Rate per 1,000	Greater (+) or less (−) than rate for all occupied males.	Ratio to rate for all occupied males.
15 to 19 years....	0.54	1.01	+0.47	187	0.24	0.14	−0.10	58
20 to 24 years....	1.55	2.90	+1.35	187	.48	.46	−.02	96
25 to 34 years....	2.03	3.18	+1.15	157	.77	.56	−.21	73
35 to 44 years....	2.74	4.24	+1.50	155	1.66	1.30	−.36	78
45 to 54 years....	3.04	4.18	+1.14	138	3.32	2.80	−.52	84
55 to 64 years....	2.16	2.57	+ .41	119	6.54	5.54	−1.00	85
65 years and over	1.11	1.59	+ .48	143	17.77	17.34	−.43	98

In the Switzerland statistics the consumption death rates of shoemakers were excessive at all ages, thus confirming in a convincing way the English data. The following table gives the data for Switzerland in detail by divisional periods of life:

MORTALITY FROM CONSUMPTION AMONG **SHOEMAKERS**, COMPARED WITH THAT OF ALL OCCUPIED MALES IN SWITZERLAND, 1879 TO 1890, BY AGE GROUPS.

[Figures from Vital Statistics of Switzerland, 1871 to 1890, Part III.]

Age at death.	Death rate per 1,000 for all occupied males.	Death rate for shoemakers.		
		Rate per 1,000.	Greater (+) or less (−) than rate for all occupied males.	Ratio to rate for all occupied males.
15 to 19 years.....	1.30	1.41	+0.11	108
20 to 29 years.....	3.04	3.52	+ .48	116
30 to 39 years.....	3.66	3.95	+ .29	108
40 to 49 years.....	3.65	4.10	+ .45	112
50 to 59 years.....	3.52	5.35	+1.83	152
60 to 69 years.....	3.25	5.19	+1.94	160
70 years and over	1.84	4.22	+2.38	229

The recorded industrial insurance mortality statistics of boot and shoe makers include 1,930 deaths from all causes, of which 371, or 19.2 per cent, were from consumption. Of the mortality of boot and shoe makers from other respiratory diseases 173 were from pneumonia, 41 from bronchitis, 30 from asthma, and 34 from other less frequent respiratory diseases. Combining the deaths from consumption and from other respiratory diseases, it is found that 33.6 per cent of the total mortality of boot and shoe makers was from diseases of the lungs

and air passages. While the consumption mortality of boot and shoe makers was excessive at all ages, the excess was most pronounced at 25 to 34, when out of every 100 deaths from all causes 50.3 were from consumption, against a normal expected proportion of 31.3. The analysis of the consumption mortality of boot and shoe makers is set forth in detail in the following table:

PROPORTIONATE MORTALITY FROM CONSUMPTION AMONG **BOOT AND SHOE MAKERS**, 1897 TO 1906, COMPARED WITH THAT OF ALL MALES IN THE REGISTRATION AREA OF THE UNITED STATES, 1900 TO 1906, BY AGE GROUPS.

[Figures for boot and shoe makers from experience of an industrial insurance company; figures for males in registration area computed from mortality statistics of the United States census.]

Age at death.	Deaths of boot and shoe makers, 1897 to 1906, due to—		Per cent of deaths due to consumption among—	
	All causes.	Consumption.	Boot and shoe makers.	Males in registration area, 1900 to 1906.
15 to 24 years.....	189	58	41.7	27.8
25 to 34 years.....	185	93	50.3	31.3
35 to 44 years.....	179	69	38.5	23.6
45 to 54 years.....	252	61	24.2	15.0
55 to 64 years.....	467	54	11.6	8.1
65 years and over.....	708	36	5.1	2.7
Total.....	1,980	371	19.2	14.8

The preceding observations and statistical data, derived from both American and foreign sources, clearly indicate that boot and shoe makers are subject to an excessive mortality from consumption and from other respiratory diseases. The excess in the mortality from consumption is, without doubt, in part at least, the result of continuous and considerable exposure to organic dust.

CORK CUTTING AND GRINDING.^(a)

The cork industry in the United States is of very limited extent, employing in 1900 only 2,340 wage-earners in 62 establishments. Of the total number employed 1,013 were adult males, 1,144 adult females, and 183 children under 16 years of age. There has been some progress in the industry since 1890, when the number of wage-earners was returned by the census as 2,019, but from a commercial point of view the growth of the industry has been much more rapid, as indicated by the increase in the value of the manufactured product from \$2,840,359 to \$4,392,364 during the decade ending with 1900.

^a For an interesting account of the manufacture of cork, with special reference to the use of machinery, reference may be had to an illustrated article on the subject in Popular Science Monthly for September, 1887.

The industry is concentrated in a few States, chiefly New York with 24 establishments, Pennsylvania with 10, and New Jersey with 8.

The cork industry has undergone material modification within recent years, chiefly resulting from the introduction of cork cutting and sorting machinery, but the use of machinery is limited on account of the variable character of the material. As brought out in the report of the Commissioner of Labor on hand and machine labor, published in 1899, the work under modern methods is being done in from one-third to one-half the time required under the more primitive methods. The industry has never attained to very considerable proportions in this country, being chiefly centered in Spain, Portugal, and Germany. Cork cutting was introduced into northern Germany near the close of the eighteenth century, and it has continued to remain one of the leading industrial pursuits in the flat lands at Hasbergen and Delmenhorst in the vicinity of Bremen. In a descriptive account published in *Die Gartenlaube* for 1888 (No. 39) it is stated that the two main divisions of labor are cutting and sorting, both of which, according to the description, are evidently accompanied by the production of considerable quantities of dust. Cork cutting by hand is a comparatively simple process, which is even more simplified when machines are used either for cutting or boring purposes. In northern Germany, where the cutting of cork is still to a considerable extent a domestic industry, the cork bark being delivered in quantities to the homes of the workmen and the finished product being returned to the factory for sorting and other purposes, the conditions are quite different from those common in the United States. In this country most of the cork is cut as well as sorted and otherwise manipulated in the factory, which, at least, differs in one essential from cork cutting as a domestic industry, and that is that the employment of small children is practically eliminated. In northern Germany practically the entire family helps more or less to increase the product and the scant earnings of the family, with the exposure on the part of even the very young to the not inconsiderable quantities of dust resulting from the handling of the material. During the cutting process proper it is not so much the dust of the cork itself as of the dirt, sand, etc., adhering to the cork bark. The amount of waste in cork cutting, however, is enormous, and it is only within very recent years that this waste has been turned to economic uses, chiefly in connection with the manufacture of linoleum. For the last-named purpose the cork waste is ground and subsequently mixed with linseed oil and other substances. Powdered cork is also used for filling in horse collars, for making mats, and for a number of other industrial purposes.

The sanitary aspects of cork cutting, sorting, and grinding have not attracted much attention, which might be accepted as evidence

that the consequences of this employment are not decidedly injurious to health and a predisposing factor to consumption. But in view of the fact that the number of persons employed in this industry is not very large it is more probable that on account of its limited extent the employment has not attracted the attention of those who have made inquiry into the mortality of different trades.

In 1889 a report was made to the Department of State by United States Consul Monaghan on labor conditions in Mannheim, where the cork industry is of considerable extent. The consul states in his report that persons employed in the various cork factories "are, as a rule, rugged, healthy, and strong," and that "the factories are well ventilated and subjected to careful and rigorous inspection."

Thackrah very briefly refers to the employment, stating only that "cork cutters have little other inconvenience than the generally sedentary character of the employ. The dust which attends the burning of the cork produces a sense of suffocation, but this process is only occasional."

The process of cork grinding preliminary to linoleum manufacture has been described as follows:

The crude material for the production of ground and powdered cork consists almost exclusively of the waste of cork industry, and is used extensively in the manufacture of linoleum. This waste consists of pieces of cork up to a cubic inch in size. The comminution, accompanied by a great generation of dust, is carried on by degrees. As a preliminary step machines divide the material into small pieces. The second step is grinding them in mills into a fine powder or flour. This work is not without danger, because the cork dust is easily inflammable and, if lighted, explodes with great force. The scraps of iron which frequently are among the particles of cork often cause explosion by producing sparks in passing through the mills. The parts of the machines which cut the cork into little particles are rapidly revolving adjustable rollers or plates studded with cutting teeth.

The pulverization of the particles of cork thus obtained is accomplished by two methods. According to the older method with rasps consisting of large, rapidly revolving drums studded with sawteeth, against which the material is pressed by two slowly revolving feeder rollers. In the newer method flat-stone mills are used, whose whole construction is very similar to the ordinary flour-grinding mills. The cork flour is passed through the mills several times until all the particles possess the required fineness. During these several passages the ground material is separated into various classes by means of drum sieves containing about 1,000 meshes to every square inch.

As a result of this process, in which not even exhausters are efficient, it can easily be seen that the workman and the neighborhood are exposed to great annoyances because of the very fine consistency and exceeding small specific weight of the ground cork. This finely ground cork dust is carried away by the slightest disturbances of the

air and transported for long distances. It is very injurious to the respiratory organs.^(a)

The preceding conclusions are confirmed by the opinions of other authorities on occupation diseases, although the industry, as previously stated, has not as yet attracted very much attention. Parry states that "explosions may arise during the powdering of the cork, or during the mixing of the cork and cement" in the process of linoleum manufacture,^(b) while Inspector Crampton, for the south London district, makes the following statement: "An industry which I have noticed as productive of much dust is the making of ordinary corks for bottles, and I have requested the introduction of fans to remove the dust at the point of origin."^(c)

While the foregoing observations are not entirely conclusive and statistical data of sickness or mortality are not available, it is evident that the employment may properly be included in a classification of dusty trades, in which the exposure to dust inhalation is a contributory factor in the mortality from consumption. As indicated in the quotation from the Report of the Chief Factory Inspector of England, it is possible to materially improve the conditions of work by the introduction of effective ventilating apparatus. Further inquiry into the hygiene of this employment would be both interesting and valuable.

MANUFACTURE OF PEARL AND BONE BUTTONS.

The hygiene of button manufacture requires careful discrimination as to the method used in button making, which may broadly be divided into metallic and nonmetallic to distinguish precisely the specific character of the dust exposure of the employments. For the present purpose only the manufacture of nonmetallic buttons can be considered as falling strictly within the classification of occupations with exposure to organic dust.

Of the total button product of the United States in 1905, according to the census of manufactures, about half the product, as measured by quantity, consists of pearl buttons made from fresh-water or ocean shells, vegetable ivory, bone, composition, and buttons made of other materials of organic origin. The number of wage-earners employed in the button industry as a whole was returned in 1905 as 10,567, against 8,685 in 1900 and 3,831 in 1890. Of the 10,567 wage-earners

^a "Factory sanitation and labor protection," by Dr. C. F. W. Doehring, Bulletin No. 44, Department of Labor, January, 1903, pp. 71, 72.

^b The Risks and Dangers of Various Occupations, by L. A. Parry, M. D., p. 156.

^c Annual Report of the Chief Inspector of Factories and Workshops for the year 1906, p. 13.

employed in button manufacture in 1905, 5,085 are specifically returned as having been employed in the manufacture of fresh-water pearl buttons, while 1,001 wage-earners were employed in the manufacture of vegetable-ivory buttons. The number employed in other branches of the industry is not specifically returned.

The manufacture of fresh-water pearl button blanks is centered in Iowa and Illinois, the manufacture of fresh-water pearl buttons in New York, Iowa, and Pennsylvania, the manufacture of bone buttons in Pennsylvania, of composition buttons in Pennsylvania and New York, of horn buttons in Connecticut, of ocean-pearl buttons in New York, New Jersey, and Pennsylvania, while vegetable-ivory buttons are made chiefly in New York, Massachusetts, and New Jersey.

On account of the wide dispersion of the industry the labor conditions naturally vary to a considerable extent, but the most important differences in the conditions affecting health are those arising out of the materials used in button manufacture.

In connection with the census of 1900 is given a brief outline of the industrial processes in the different branches of the industry, from which the following brief extracts are made:

Regarding the manufacture of horn buttons, it is stated that—

The raw material of the horn button is generally the hoofs of cattle. The hoofs are boiled in large kettles, which process softens them; then they are cut by machines into pieces, which other machines form into buttons. These go under a hydraulic press, which stamps the desired patterns upon them. Still different machines are used for boring holes and for polishing.^(a)

The process of making vegetable-ivory buttons, first introduced into the United States in 1859, is described as follows:

The raw material is the seed of the fruit of *Phytelephas Macrocarpa*, a low-growing palm of South America; the principal shipping point for which is Colon, Colombia. The seed is commonly known as the ivory nut, and is about the size of a hen's egg. The albumen is close grained and very hard, resembling the finest ivory in texture and color. These nuts are either cut in halves, from which the buttons are sawed out, or sawed in small blocks, from which the larger buttons are formed. The vegetable ivory is especially adapted to the application of colors. The methods of manufacture of the vegetable-ivory buttons have changed very little since the time of its introduction here, but great progress has been made in the dyeing of the buttons in various colors and patterns, and also in the finish, and to-day the products of the home factories rival the European product. This branch of the industry ranks third.^(a)

Closely resembling buttons made from vegetable ivory are buttons made from composition material, according to a process first intro-

^a Report on Manufactures, Part III, Twelfth Census of the United States, 1900, p. 322.

duced into the United States in 1875. It is stated these buttons closely resemble those manufactured from vegetable ivory and that they—

are made of plastic material, i. e., a mass which softens under the influence of heat and becomes hard when cold. The ingredients used are certain fossil and vegetable gums, combined with finely comminuted carbonate of lime, feldspar, mica, or kindred minerals. These ingredients are thoroughly mixed in steam-heated grinders. When the minerals are properly amalgamated with the gums, the mass is run off in sheets and allowed to cool. Later these sheets are placed on hot platens, contact with which softens them, and facilitates cutting into strips of convenient form for placing in the dies.^(a)

Buttons are also made in large quantities from celluloid, potatoes, casein, blood, and other organic materials, a descriptive account of which is not available to sufficiently emphasize the possibly health-injurious processes arising in connection with their manufacture.

The most important branches of the button industry of to-day in the United States is the manufacture of pearl buttons, including fresh-water pearls from the Mississippi. In 1900 the production of these varieties of buttons formed 48.4 per cent of the total product reported for the entire button industry of the United States. This process was first introduced in 1855, having since grown to very considerable proportions. The mechanical processes of pearl-button manufacture as carried on in the United States at the present time are described in the following statement:

After the mussels have been cooked and the meat removed, the shells are taken to the factories and stored in sheds. They are then sorted into three different sizes and soaked in barrels of water from three to six days to render them less brittle. They must be used while wet, otherwise they crumble under the saw. The next step is the cutting or sawing of the rough blanks. The shells are usually held with pliers while being cut, but some sawers hold them in their hands. The saws are hollow, cylindrical pieces of steel, 2 inches wide, and with a diameter corresponding to the size of the button. At one end these cylinders are provided with fine teeth; they are adjusted to lathes in which they revolve. As the sawer holds the shell against the saw, the blanks are cut out and passed back into the saw and saw holder and drop into a receiver. The next step is the dressing or grinding of the back of the blank to remove the skin and make an even surface. To accomplish this, each blank has to be held with the finger against a revolving emery wheel. Then comes the turning, by which the front of the button is given its form, including the central depression. When the holes are drilled the button is complete, with the exception of the polishing process, which brings out the natural luster which was lost in the grinding. It is this luster which gives the buttons their chief value. The polishing is effected by placing the buttons in bulk in large wooden tumblers or kegs, in which they are

^a Report on Manufactures, Part III, Twelfth Census of the United States, 1900, p. 322.

subjected to the action of a chemical fluid as the tumblers revolve. By mutual contact, combined with the effect of the fluid, the buttons become highly lustrous. Then they are washed, dried, and sorted into sizes and grades of quality. After being sewed on cards and packed in pasteboard boxes, the buttons are ready for the market.^(a)

It is evident from the foregoing description that the sanitary conditions of this industry are more or less prejudicial to health, chiefly, of course, on account of the exposure to considerable and continuous inhalation of very fine organic dust. The subject has attracted the attention of most of the authorities on occupation diseases, and as early as 1832 Thackrah observed that—

The makers of bone buttons are subjected to some dust, but this is not sufficient to produce sensible disorder. The makers of pearl buttons appear to suffer more. The pearl dust produces often bronchial irritation, and this excites pulmonary consumption in individuals predisposed to the disease. Both classes of button makers are, in Birmingham at least, generally intemperate, devoting two days a week to the impairment of their health.^(b)

Halfort, writing in 1845, relies almost entirely upon Thackrah, confirming his conclusions that exposure to the dust of horn and mother-of-pearl is a predisposing cause in bronchial catarrh and in consumption of the lungs.

The first extended inquiry into the hygiene of the employment was made in France during the early fifties, reference to which is made in the report by Dr. Waller Lewis, published as a parliamentary report in 1855. The report calls attention to the generation of large quantities of dust, not only of the material itself but also of the grindstones used in grinding and polishing processes. Of the dust produced in the manufacture of mother-of-pearl, it is stated that—

This dust, of a yellowish white color, is exceedingly abundant; it is very light, and composed of small grains, excessively thin, which give to the touch a rough and sandy sensation. As soon as one enters a workshop where five or six cutters are working, you are suffocated by this dust, and feel a slight smell of animal matter. This odor is due to the composition of the shells, which inclose an organic animal matter, more or less abundant, according to the age of the mollusk, etc. The fibrous and nacreous structure is that part which generally contains most animal matter, and consequently gives off most of the dust. This explains how it is that the water in which the grindstone bathes becomes so quickly putrid, and renders the work of the mill still more insalubrious.^(c)

^a Report on Manufactures, Part III, Twelfth Census of the United States, 1900, p. 323.

^b Effects of Arts, Trades, and Professions on Health and Longevity, by C. Turner Thackrah, 1832, p. 55.

^c Parliamentary Report, The Laws and Ordonnances in Force in France for the Regulation of Noxious Trades and Occupations, by Dr. Waller Lewis, p. 59.

The resulting consequences of continuous and considerable exposure to the inhalation of dust of mother-of-pearl are stated to be chronic bronchitis, hemoptysis, ophthalmia, and other afflictions, for the author of the report observes that—

The thin and abundant dust which escapes from the shell when being sawn, and while being worked on the mill or stone, evidently causes these affections of the organs of respiration and sight. Completely inert, this dust enters into the ramifications of the bronchi, but seldom into the smallest of them, and produces in them an irritation which augments the mucous secretion; the mucous membranes thicken, and cause, especially in the morning, and sometimes during work, a very exhausting cough, followed by considerable expectoration. Chronic bronchitis, frequently complicated with hemoptysis, and still more frequently with pulmonary emphysema, quickly ensues.

The women who are mostly employed in * * * placing the buttons on cards, suffer much from chlorosis and similar anæmic complaints, but this depends much upon their bad sanitary state, and on the sedentary nature of their employment. The workmen do not appear to be more subject to phthisis than others, but they are very liable to chronic troublesome asthma,^(a) which does not leave them even after their change of employment.^(b)

In 1861 the medical officer of the Privy Council published a report on the hygiene of button making in the Birmingham district, chiefly with reference to the manufacture of buttons made of mother-of-pearl. It is stated in the report that—

Button making is one of the staple manufactures of Birmingham, and affords employment to a large number of persons of both sexes and of all ages from 6 or 7 years upwards. It is almost exclusively the pearl-button makers, of whom there are a great number in Birmingham, who suffer from inhaling dust. Bone and vegetable ivory button makers are much less exposed to breathe a dusty atmosphere, and no conclusive evidence of their suffering from irritative disease of the lungs was obtained. Pearl buttons are cut out of shell, and both in the process of cutting out the disks, and also in those of forming and polishing the buttons on the lathe, much dust is evolved. The danger to health from inhaling dust was aggravated in several of the button factories, visited during the inquiry, by the overcrowded, ill-ventilated state of the workshops * * *.^(c)

After pointing out that many females were employed in this manufacture, and that many of the laborers work for long hours, often until far into the night, the report continues that—

There was much discrepancy in the evidence regarding the influence of the occupation on health, collected in different shops used for

^a This form of asthma was, in all probability, fibroid phthisis, not clearly differentiated from general tuberculosis.

^b Parliamentary Report, The Laws and Ordonnances in Force in France for the Regulation of Noxious Trades and Occupations, by Dr. Waller Lewis, p. 59.

^c Fourth Report of the Medical Officer of the Privy Council, 1861, pp. 143, 144.

the manufacture of pearl buttons. In some instances the operatives declared their occupation to be entirely harmless; whilst in others abundant evidence was obtained, from both masters and men, that the work people employed in this branch of manufacture suffer much from irritation of the lungs in consequence of inhaling air charged with dust. Further inquiry, and especially a careful examination of the processes of manufacture, showed that this contrariety of evidence arose from a corresponding difference in the kind of article manufactured; much less dust being created in making small buttons, such as are suitable for shirt fronts and similar purposes, than in making those of a larger size.^(a)

The foregoing extract emphasizes the extreme care necessary in discriminating between the different employments of button manufacture. The report states further that—

The injurious influence of the pearl-button manufacture on health was further confirmed by evidence afforded by Doctor Russell, physician to the general hospital, * * * and by Doctor Johnstone, another of the physicians to the same institution. One manufacturer represented himself as suffering from the ill effects of the occupation, and said that many of his work people were affected in a like manner, few escaping the injurious effects of their employment on reaching the middle period of life. The superintendent of another factory reported himself to have long suffered from cough and expectoration produced by inhaling the mother-of-pearl dust, adding that this result of the occupation is now so well known that many of the benefit societies of Birmingham will no longer admit pearl-button makers into membership. As might be expected, the disease from which the pearl-button makers suffer in consequence of their trade is chronic bronchitis. This disease runs a very slow course, often lasting many years before finally disabling its subject. Hemoptysis appears to be a not infrequent attendant on the complaint when fully established.^(a)

The inhalation of mother-of-pearl dust is, however, not only injurious to the lungs and air passages, but, as pointed out by Dr. B. W. Richardson in 1876, the dust is also a causative factor in producing a serious disease of the bones, to which the name of "osteitis" has been given to clearly differentiate it from other and perhaps similar afflictions. According to Doctor Richardson, in his lecture on "Unhealthy trades," delivered before the Society of Arts in 1876—

This disease, first described by Englisch, as attacking mother-of-pearl turners, has since been studied by Gussenbauer, Klauser, Hirt, and Merkel. Gussenbauer and Klauser have made an analysis of the three different layers of which the pearl shell is composed. The most internal layer is the one used by mother-of-pearl turners. It contains of organic matter insoluble in water 5.57, of organic matter soluble in water 0.11, of water 0.47, of carbonate of lime 93.555, and of alkaline salts 0.295 per cent. The disease of the bones that has

^a Fourth Report of the Medical Officer of the Privy Council, 1861, p. 144.

been observed as incidental to the turning of this substance attacks only youths, before the skeleton is fully developed. It is characterized by a sudden pain, which is neither increased by pressure nor motion. A swelling, first from the periosteum, or covering of the bone, and afterwards from the bone itself, shows itself at the ends of the bones at what are called the "epiphyses." The soft elastic swelling is sometimes fluctuating. Its development is accompanied by fever; it enlarges in the direction of the length of the bone; in time it becomes harder, and it rarely suppurates. As a rule, the tumor resolves. It often attacks several points of the skeleton at the same time, and it has a tendency to return. The bones that have been observed as affected in seven cases under the observation of Gussenbauer, in youths of from 14 to 16 years, are the radius of the arm, the ulna, the lower jawbone, and the thigh bone. In one instance several bones were attacked successively in the same subject—namely, the left metatarsal and cubit bones, the left shoulder blade, the left arm bone, the humerus, the cuboids, and the right astragalus or heel bone.

Gussenbauer, to whom I am indebted for these descriptions—the disease not yet having been described in our country—is of opinion that the malady is produced in the following manner: The dust enters the lungs, penetrates the cellular structure of those organs, enters the lymphatic vessels and glands, and is decomposed. Under the influence of the carbonic acid of the venous blood, the calcareous carbonates are dissolved, the insoluble organic matter remains, and is the substance called "conchyoline," discovered by M. Fremy. This penetrates the vessels, and is carried by the current of the arterial blood into the minute vessels. In the reduced vessels of the bone at the epiphyses, it finds resistance and deposits there, causing the swelling and the other symptoms which have been described above, and which continue until the foreign body is resolved and removed. Such is the ingenious theory of the origin of the bone disease of the pearl turner. We need not discuss the theory, it is sufficient to have before us the facts at this moment.^(a)

The hygiene of pearl-button manufacture was also considered by Arlidge, who, in his work on diseases of occupations, sums up his conclusions in the statement that—

The cutting, turning, drilling, and polishing of mother-of-pearl are attended by a large amount of heavy dust, which, from its composition, operates on the respiratory organs in the same fashion and degree as mineral dust. What are the lesions produced by its inhalation we have the great advantage of learning from Dr. Headlam Greenhow, who described them in the Transactions of the London Pathological Society (Vol. XXI, p. 66). This excellent pathologist stated that he had satisfied himself of the identity of the lung affections of these workmen with those "of miners, potters, flax dressers, and other operatives exposed to inhale air charged with dust." The symptomatology, moreover, is alike between them, and especially the long existence of shortness of breath before cough and other indications of broken-down health and lung lesion evidence themselves.^(b)

^a Lecture on "Unhealthy trades," by Dr. B. W. Richardson, Scientific American Supplement, February 26, 1876, p. 138.

^b Diseases of Occupations, by J. T. Arlidge, pp. 323, 324.

Arlidge refers also to an account of the diseases of pearl-button makers by Layet, who, in his opinion, rightly insists that men in this employment suffer increased injury—

by leaning forward in working the lathe, and thereby bringing the nose and mouth into proximity with the shell and the dust arising from it. He also remarks on the sickening odor of the dust, dependent on the remnants of decomposing animal matter existing in it. Besides the respiratory troubles—obstinate cough, asthma, and free expectoration of mucopus, and occasionally of blood in small quantity, he notes the occurrence of blepharitis and conjunctivitis, and the formation of fissures in the skin of the hands. A concluding observation is, that although they suffer so seriously with lung affections, their mortality from tubercular phthisis does not exceed the ratio found among other artisans.^(a)

Finally, according to Arlidge—

The ill consequences of mother-of-pearl work are aggravated by the accidental circumstance, that it is an occupation open to any mechanic of ordinary skill without the expenditure of capital upon plant. Few tools are required, and it can be carried on by females and children in their cottage homes, where sanitary arrangements to lessen its evils are unknown or unused, and the hours of labor extended at pleasure. Another reason for a high mortality is to be found in prevailing intemperance and dissipation, coupled with a low rate of earnings, and indifferent, if not decidedly bad food and lodging.^(b)

While the various authorities on the diseases of workers in mother-of-pearl are not entirely agreed as to the health-injurious consequences of the employment, it is evident that the dust generated during the various processes is seriously detrimental to health even though not necessarily a decidedly predisposing cause of consumption. Every descriptive account of the industry, including a special report of the Iowa bureau of labor statistics (1898) and several illustrated accounts in the *Scientific American*, emphasizes the serious risk of dust exposure in the different employments and the necessity of adequate and effective ventilating apparatus. While the conditions are possibly more serious in the manufacture of pearl buttons than in the manufacture of buttons of other material of organic origin, the conclusions which apply to the former also apply more or less to the latter.

Oliver, in his article on "Dust as a cause of occupation disease," illustrated by micro-photographs, includes an illustration of mother-of-pearl dust, observing that Hirt regarded this trade as extremely dangerous and found that from 15 to 16 per cent of the men engaged therein died from phthisis. After referring to the conclusions of Gussenbauer, that turners of mother-of-pearl suffered from a pe-

^a Diseases of Occupations, by J. T. Arlidge, p. 324.

^b Idem, p. 326.

culiar affection of the bones, also referred to by Doctor Richardson, Oliver states that he had visited mother-of-pearl grinding shops in Sheffield and had questioned the workmen employed, but had been unable to find any evidence to support the contention of Gussenbauer as to the occurrence of osteomyelitis resulting from the absorption of carbonate of lime from particles of shell inhaled during the mechanical processes of the industry. He concludes, however, with the statement that the grinding of mother-of-pearl in Sheffield is done by the wet process, which may account for the material difference in the results and conditions observed.^(a)

The industry is very briefly referred to in the report of the state board of health of Massachusetts on factory conditions for 1907. It is stated that much dust arises in the several processes of drilling, turning, and polishing, but that the dust is very light, and in well-equipped factories is effectively carried away by exhaust blowers. Polishing by the wet process is unattended by dust. Two pearl-button factories were inspected but no objectionable conditions whatever were found to exist. The light, ventilation, and general health of the employees were reported as good.

It is evident from the foregoing summary of observations by the leading authorities on the hygiene of pearl and other button manufacture of organic origin that the conditions affecting health vary widely and probably in exact proportion as effective methods of ventilation and dust removal are employed.

While the available evidence regarding the hygiene of button manufacture, chiefly with reference to the making of buttons of mother-of-pearl, is amply sufficient to warrant the conclusion that the employment requires to be classed among the dusty trades, with a decided liability to respiratory diseases, and in particular chronic bronchitis, which, according to circumstances, may assume the form of either fibroid phthisis or general tuberculosis, it is evident from the various accounts which have been rendered that in many of the establishments the conditions affecting health and life are very far from what they should be, and that the employment is one which requires strict sanitary supervision through both the board of health and the factory-inspection authorities.

The vital statistics of button makers are limited to the recorded industrial mortality statistics. These include 127 deaths from all causes, 48, or 37.8 per cent, of which were from consumption. Of the mortality of button makers from respiratory diseases other than consumption 11 were from pneumonia, 1 from asthma, and 2 from less frequent respiratory diseases. Consumption and other respiratory diseases together caused 48.8 per cent of all the deaths of button

^a Dangerous Trades, by Thomas Oliver, p. 276.

makers. The following detailed tabular presentation of the proportionate consumption mortality by divisional periods of life shows an excessive mortality from consumption among button makers at all ages. The excess is most pronounced at ages 15 to 24, when out of every 100 deaths from all causes 50.0 were caused by consumption against a normal expected proportion of 27.8.

PROPORTIONATE MORTALITY FROM CONSUMPTION AMONG **BUTTON MAKERS**, 1897 TO 1906, COMPARED WITH THAT OF ALL MALES IN THE REGISTRATION AREA OF THE UNITED STATES, 1900 TO 1906, BY AGE GROUPS.

[Figures for button makers from experience of an industrial insurance company; figures for males in registration area computed from mortality statistics of the United States census.]

Age at death.	Deaths of button makers, 1897 to 1906, due to—		Per cent of deaths due to consumption among—	
	All causes.	Consumption.	Button makers.	Males in registration area, 1900 to 1906.
15 to 24 years.....	24	12	50.0	27.8
25 to 34 years.....	31	16	51.6	31.3
35 to 44 years.....	32	12	37.5	23.6
45 to 54 years.....	24	6	25.0	15.0
55 to 64 years.....	6	1	16.7	8.1
65 years and over	10	1	10.0	2.7
Total.....	127	48	37.8	14.8

The mortality statistics of industrial insurance experience fully confirm the preceding observations and quite conclusively prove that button makers as a class are exposed to conditions more or less injurious to health and life. The industry is one of sufficient importance to warrant a more thorough and qualified investigation than has thus far been made.

COMB MANUFACTURE.

The general hygiene and labor conditions of comb manufacture are much the same as in the manufacture of buttons of similar material. Combs, including hairpins and ornamental articles for personal use, are made of a large variety of substances, chiefly horn, bone, ivory, tortoise shell, composition material, celluloid, and the various metals. It is not possible to differentiate clearly the various branches of comb manufacture according to the kinds of materials used, but for the present purpose only those branches are considered in which the material used is of organic origin.

The census report on manufactures for 1905 returned 42 establishments engaged in the manufacture of combs, employing 1,806 wage-earners, including 322 women and children. Most of the establishments are of small size, but in 8 out of the 42 more than 100 persons were employed. Including the making of hairpins and

similar articles for ornamental use, the industry is of larger extent than indicated by the census report. The industry has increased rapidly within recent years—from 742 wage-earners in 1890 to 1,399 in 1900 and to 1,806 in 1905.

The hygiene of comb manufacture has not attracted much attention, but as early as 1832 Thackrah observed regarding comb makers that they were exposed to a disagreeable odor from the bullocks' hoofs, but that they were healthy and long-lived.

Halfort, writing in 1845, did not consider the occupation except in so far that he observed with reference to the manufacture of horn buttons that considerable dust was generated during the processes of turning, grinding, and polishing, in consequence of which serious lung diseases were frequently met with among the workmen.

The first extended consideration given to the industry was by Hirt, who, writing in 1871, included horn and bone dusts as practically identical in their effects upon the human organism. He called attention to the large quantities of dust produced during the processes of horn and bone sawing, boring, filing, and turning, resembling in its exterior effects the exposure to flour dust in flour mills. Microscopically examined, the dust was of infinite variety in its mechanical properties, the amount of dust produced being largest, as a matter of course, in bone-grinding establishments. The first effect of bone dust, according to Hirt, was but very slight, and even continuous exposure on the part of the workmen did not apparently lead to serious injuries, so that no complaint on this account was made to Hirt by the workmen personally interrogated. Individual cases were brought to his attention in which after fifteen years of work no injury to the lungs could be traced to the continuous and considerable exposure to bone dust. In contrast, however, he discovered that a predisposition to chronic pneumonia and similar lung affections was common, and that these diseases formed a large proportion of those occurring among the workmen. It was ascertained by Hirt that about 20 per cent of the morbidity was from phthisis, and that chronic catarrh of the respiratory organs was extremely common, without, however, assuming the most serious type of chronic asthma. In a general way, however, the health of the workmen was very good and the average age at death was between 57 and 60 years. These statements relate almost entirely to men exposed to bone dust; and, in fact, Hirt refers particularly to bone turners, stating that according to observed experience they were liable to a relatively high general morbidity, exceeded only by a few other occupations, among which he mentions rope makers and bakers. Among bone turners, according to Hirt, phthisis caused 16.2 per cent of the morbidity, asthma 1.8 per cent, chronic bronchial catarrh 9.3 per cent, and pneumonia 5.6 per cent, a total of chest and throat affections of 32.9 per cent, which,

however, compared or contrasted with the morbidity in certain other employments with continuous and considerable dust exposure, was not considered excessive by Hirt, who wrote, of course, with special reference to observed conditions of labor and life in Germany. The favorable conclusions of Hirt, however, were apparently confirmed by those of Lombard, who ascertained an average age at death in the case of bone turners of 57.4 years, arrived at, however, upon the basis of only a very small number of observed cases.

With special reference to horn dust, Hirt states that on account of the limited extent of the industry no very conclusive observations had been made a matter of record, and the employment was complicated by the fact that horn dust was often mixed with bone dust, making it difficult, if not impossible, to differentiate between the exact effects upon the human organism of either of these two varieties of dust. In the manipulation of horn for grinding, polishing, turning, and boring purposes, according to Hirt, the quantity of dust generated was, however, much less than in the case of bone manufacture, as by its mechanical properties the dust particles of horn were heavier and not so easily mixed with the general atmosphere. Microscopically examined, however, it was ascertained that there were more sharp and pointed particles of dust produced in horn manufacture, explaining the more immediately injurious or irritating effects of horn than of bone dust exposure. While, according to Hirt, there were few workmen exposed to horn dust who were entirely free from catarrh, phthisis was not excessively common. He states that the proportion of cases of phthisis in the general morbidity was only 15 per cent, or less than among bone turners, as previously explained. The small number of men employed exclusively in the manufacture of articles of horn precluded entirely safe conclusions.

The hygiene of comb making is considered by Arlidge in his treatise on the Diseases of Occupations. After pointing out that the industry is of very limited character, and that at the time he wrote (1892) it was carried on in England in small factories, which had superseded domestic workshops, and, further, that the material used is chiefly of animal origin in the shape of horn, bone, tortoise shell, or ivory, he observes that—

The operations concerned in making these several articles are simple, and require no elaborate machinery. Those suggestive of ill results to health are chiefly sawing and turning. The maceration of horns in water to open them out, and their subsequent flattening by superimposed pressure, are operations devoid of injury to health; but the next proceeding, that of cutting them into laminæ by means of circular saws, is productive of a large quantity of dust. Polishing is free from this evil, as it is done by heat and pressure. Tortoise shell is dealt with in a similar fashion, but requires, as a preliminary

process, boiling for some time in water to which salt is added. Both horn and tortoise shell can be cast in molds by the aid of heat, after first being reduced to powder.^(a)

It is evident from the foregoing account, based no doubt on personal observation, that a considerable quantity of dust is generated in the process of comb manufacture, but according to Arlidge the dust, although visible in the form of a cloud, is apparently almost harmless. This he explains is probably the result of its animal origin, which prevents its being as much of an irritant to the pulmonary tissue as dusts of mineral and metallic origin. Arlidge, however, agrees with Hirt, that it is entirely conceivable that the dust may be the cause of bronchitis. He continues his remarks in part as follows:

According to Hirt, dusts of animal origin are more prejudicial to health than those derived from the vegetable world; and that where the latter produce 11 to 13 per cent. of the mortality of sick people, the former cause 20 per cent. We have no means of testing the accuracy of these comparative figures, but must feel some scepticism regarding them. As to the dust of mother-of-pearl, and, in a lesser degree, that of fossil ivory, we are quite ready to admit their position among the more destructive varieties of dust. But with regard to bone, tortoise shell, and horn, there is no evidence that the dust generated by their employment is of like serious moment to health. In fact, looking to what experience teaches regarding horn, we are justified in the belief that substances of a gelatinous nature are but slightly obnoxious to the lungs.^(b)

With special reference to persons employed in the manufacture of combs and other small articles made from such substances, Arlidge observes that they are admittedly very free from ill consequences, and apparently look well nourished. The latter he attributes in part to the gelatinous dust in which they work, but without going so far as to admit a nutritious value to the material, he is of the opinion "that the finely powdered horn tissue may undergo dissolution in the warm secretion of the mucous membrane and undergo absorption, just as happens with catgut ligatures left within a cavity of the body."

The evidence available to Arlidge and others was, however, apparently very contradictory, for he concedes that the makers of bone and of ivory buttons and of other articles of the same material are known to suffer cough and shortness of breath after following the trade for a number of years. He refers to the factory report for Sheffield, for 1887, where it is stated that men employed in the occupations referred to set free such clouds of dust that in a short time it is im-

^a Diseases of Occupations, by J. T. Arlidge, p. 219.

^b Idem, p. 421.

possible to see across the workshop, and that this bone dust is admitted to be very injurious.

The pathology of horn-dust inhalation was briefly considered by the departmental committee on compensation for industrial diseases in 1906. Dr. Arthur Hall, of Sheffield, before this committee, made the following statement:

I have no positive evidence that horn by itself is an irritating dust. But these men work in various dusts, and one is unable to say always from the lung or from the symptoms exactly which dust is the more important as an irritant, and one has to, more or less, class them all together, because sometimes they are working in one kind and sometimes in another.^(a)

This favorable view of the comparative harmlessness of horn dust inhalation was not, however, supported by any positive evidence or exact statistics of mortality and morbidity of men employed for any considerable period of time in the manufacture of horn combs and other ornamental articles of the same material.

With special reference to American conditions, the hygiene of the industry is discussed in the special report of an investigation of conditions affecting the health or safety of employees in factories and other establishments by the Massachusetts state board of health, which refers to the town of Leominster, where there are no fewer than 29 establishments, which give employment to nearly 1,900 persons in the manufacture of combs and hairpins of horn and celluloid. There are 3 other establishments of the industry in Massachusetts, 2 in Newburyport and 1 in Northborough, which give employment to about 300 persons.

The process of hairpin manufacture from horn and similar material is explained as follows:

The pressed horn is first soaked in hot water for two or three days, after which it is shaved and split. The next process is known as "polking," which includes "blanking" and "centering." Briefly stated, a flat piece of horn, little larger than is necessary for the production of two pins, is placed under the polking machine, which cuts out the pins and leaves the blank and center pieces. Such a machine is known as a double cutter; a single cutter cuts out but one pin. As the stock is held by the employee while the machine knife comes down and cuts it, there is some danger of losing a portion of the finger tips through inattention or lack of care.^(b)

Subsequent to this process the pins are taken to the rounding or edging machine, which rounds the edges, and in so doing gives rise to considerable horn dust, most of which, however, in some factories at least, is removed by blowers.

^a Report of the Departmental Committee on Compensation for Industrial Diseases, Minutes of Evidence, p. 49. London, 1907.

^b Thirty-eighth Annual Report of the State Board of Health of Massachusetts, p. 505.

The next process is pointing with a so-called pointing machine, and according to the report referred to—

The dust from this machine flies about the operator's face more freely than that from the rounding machine; but the best, and indeed most, of the factories connect these machines with exhaust blowers. From the pointing machines the pins are conveyed to the "tumblers," which are square boxes, lined with spruce, and containing fine pumice stone and water. In these they are revolved for a while, and then they are removed, rubbed, and colored with a mixture which contains usually anilin dyes, red lead, lime, and bicarbonate of sodium (saleratus). Finally, the pins are polished, bent and packed.^(a)

The processes followed in the manufacture of combs conform in a general way to the preceding descriptive account of the manufacture of hairpins.

Since an increasing proportion of articles of this kind are now made of celluloid the following extracts from the report previously referred to are included, the material used in the manufacture consisting of sheets of celluloid which are cut into small pieces by means of a long-bladed knife similar to that used in cutting paper, and this process is technically known as "slashing." The subsequent processes are described in part as follows:

The small pieces are taken to the cutting machines, which cut out the teeth of the comb. The next process is "polking," in which portions of what is to be the back of the comb are removed. For plain work, dies or cutters are used; and a curved cutting-edge die is stamped through the material, removing the blank or waste pieces, and leaving the comb of the desired shape and design (p. 505).

The comb is next taken to a machine which bevels the edges. The beveler consists of a flat steel plate, through the center of which is an opening for a small "wing burr," which is placed up through the opening to the height desired. The steel burr, or beveler, makes many revolutions per minute, and on coming in contact with the celluloid gives rise to considerable dust. The dust is, however, coarse and heavy, and most of it flies away from the operator's face. When the burr is put through the opening in such a way as to be mainly on the upper part of the steel plate, and is revolving rapidly, there is a chance of injury to the operator's fingers while holding the comb. For protection against this accident, an ingenious brass collar or "sleeve" has been devised, and is used by some of the workmen.

Circular saws then shape the bottom of the teeth to conform with the bottom of the back of the comb, the teeth having been cut straight in the first process of cutting. The saws are called "bottoming saws," and are generally guarded. A glass front, through which the employee watches his work, protects his face, and especially his eyes, against the chips of celluloid, which are thrown off with considerable force. The dust is coarse, and most of it is removed by efficient blowers.

^a Thirty-eighth Annual Report of the State Board of Health of Massachusetts, p. 505.

The next operation is "pointing" the teeth by sand wheels or steel burrs, and the latter go around so swiftly that a very strong exhaust draft does not take away all of the dust. Workmen state that the dust which flies toward the face occasionally strikes the eyes, acting like cinders in this respect; but that it is not inhaled, since the particles are heavy. The sand wheel makes, perhaps, a finer dust; but this is moist and more or less matted together, and interferes little, if any, with the comfort of the workman. Good blower systems are required by insurance companies wherever blowers may be used to advantage. Dust and shavings are not allowed to accumulate on the floor and elsewhere, on account of danger of fire, celluloid being extremely inflammable.

The backs of the combs are next engraved or carved by hand or machine. The teeth are then "grailed" by a machine which rounds the edges of the teeth. The sides or ends of the combs are then smoothed on "ending" machines or by hand.^(a)

It is explained that all the processes thus far mentioned and described in sufficient detail to emphasize the hygienic and more or less health-injurious circumstances of the trade are technically known as bench work and that the employees are mostly men, but including a few boys. After the preceding processes the combs are brought to the so-called rubbing room, where the workman stands facing his stall, with his back toward a window and fronting a trough which contains a mixture of sifted coal ashes and water, over which is a rapidly revolving cloth, or cloth and brush, ball. It is stated that—

He holds a comb against the revolving wheel, for the purpose of "rubbing down" the surface so that the comb may better take the finishing processes. With the ball making from 1,200 to 1,400 revolutions a minute, the workman becomes covered with a very fine spray of wet ash dust, and the picture of 15 or 20 men in one of these rooms is far from inviting. The room itself is plastered with ash mud, the window panes are daubed with it, and the employees are sprinkled with it from head to foot.^(b)

In connection with this process a strong odor of camphor is perceptible, which is a component of celluloid, and brought out by the friction of the rubbing. Whether this is injurious to health is not known. The rooms in which the work is carried on are commonly in more or less damp basements, which themselves are undesirable, according to the report, from a sanitary view, as workrooms. Regardless of this fact, however, and of other conditions more or less injurious to health, the employees are satisfied with their work, and many have been from five to twenty years at the trade without any visible effects of the employment. In fact, in the rubbing process some of the men have been employed from five to thirty years. Some

^a Thirty-eighth Annual Report of the State Board of Health of Massachusetts, p. 506.

^b Idem, p. 507.

of the rubbing balls, so called, are made entirely of carpeting, while others have layers of Tampico grass between the carpeting. To keep the balls in proper condition a process of trimming is necessary, which is described as being very dusty work and which is done in some shops in the rubbing room, while in others a small dust room is especially constructed for the purpose. In this process some men use respirators or sponges while doing the work, but most of them do not.

The polishing process is also performed on rapidly revolving balls made of new cotton cloth, with the use of rotten stone and lard oil. This process, it is stated, gives rise to more or less lint and mineral dust; but circular pieces of pasteboard or wooden disks are placed over the wheels to keep the dust from the operatives, and none appears to fly directly into their faces.

The subsequent process of the "bending" of the combs is chiefly the work of women and girls, and is apparently not accompanied by the production of any considerable quantity of dust. Steam tables, or so-called "heaters," are provided for the work, and these are covered with asbestos, on which the employees put blocks or "forms" of the kind desired, containing the combs, which are bent and caused to retain the shape which the particular blocks or "molds" give them. This bench work, it is stated in the report, is carried on in rooms heated to a considerable temperature, and the air in winter weather toward night becomes especially dry and foul.

The final processes of polishing with revolving chamois balls are also largely the work of women and girls, but whether accompanied by much dust is not stated.

It is evident from the foregoing descriptive accounts that considerable dust is generated in the different processes of the manufacture of combs and similar ornamental articles made of horn, bone, celluloid, etc., but that the conditions naturally vary widely or according to the processes made use of, or the particular material employed. The investigation by the Massachusetts state board of health is in part summed up in the statement that—

In the horn and celluloid industry the tendency is to have the work of soaking stock and rubbing or polishing with ashes—work which involves moisture and dust in the atmosphere of the room—done in the basement; whereas these processes should be carried on above ground, in light, large, airy rooms, preferably, perhaps, in the second story.

The "tumbling" room, where pumice stone and water are used to smooth the pins, is usually in the basement. If the basement is light and well planned, it is a good place for this work; but usually the room is dark, and far from being pleasant to work in. It is true that employees do not stay long at a time in these rooms; but a needed improvement is to have them in a well-lighted place, properly venti-

lated, with cement floor and a catch-basin connected with the sewer, to provide for thorough cleaning of the room.

A large number, if not most, of the "rubbing rooms," in which revolving carpet buff balls and sifted coal ashes are used, are in basements, which, if not damp, are unpleasant to work in, or in quarters which are open to severe criticism from a hygienic point of view. An improvement to be strongly recommended is to require, so far as is reasonably practicable, as efficient protection to the health and comfort of the operatives as is provided in the best establishments.^(a)

It is made evident by the foregoing descriptive account of the various branches of the industry that the dust nuisance can be materially reduced by effective ventilating apparatus. Reference is made in the report to one model establishment, where blowers are provided for the pointing machines but not for the rounding machines, since it is considered unnecessary, as the horn dust is moist and flies about but little. Whether this theory is in exact conformity to the facts is somewhat doubtful.

SUMMARY OF CONCLUSIONS REGARDING OCCUPATIONS WITH EXPOSURE TO ORGANIC DUST.

In the preceding observations and statistical data 15 specific occupations with exposure to organic dust have been considered in more or less detail. The data for some of the occupations are too meager to warrant final conclusions, but the information presented is quite decidedly suggestive of health-injurious conditions in certain of the occupations. The United States census returns of 1900 give the age distribution of millers, bakers, confectioners, tobacco and cigar factory operatives, leather curriers and tanners, harness and saddle makers, glove makers, and boot and shoe makers, the aggregate number of the males of known ages 15 years of age and over being 472,160. Of this number 25,336, or 5.4 per cent, had attained to the age of 65 years and over, against a normal expected proportion of 4.7. In some of the occupations, however, notably tobacco and cigar factory operatives (1.8 per cent), glove makers (2.3 per cent), bakers (2.4 per cent), leather curriers and tanners (2.9 per cent), and confectioners (3.1 per cent), the proportion of employees attaining to age 65 and over was considerably less than the average normal expected (4.7 per cent) on the basis of all occupied males in continental United States. In fact, in only three occupations did the proportion of employees attaining to age 65 and over exceed the normal expected proportion of 4.7 per cent, namely, millers (7.6 per cent), harness and saddle makers (7.2 per cent), and boot and shoe makers (8.5 per cent). The number of persons employed, however, in these

^a Thirty-eighth Annual Report of the State Board of Health of Massachusetts, pp. 508, 509.

three occupations is sufficiently large to raise the general average of the aggregate employees in the occupations considered to 5.4 per cent. The details of the age distribution are given in the following table by divisional periods of life, together with the corresponding percentage distribution of all occupied males, the data for both groups being derived from the United States census of 1900:

NUMBER AND PER CENT OF MALES IN EACH AGE GROUP IN OCCUPATIONS EXPOSED TO ORGANIC DUST, COMPARED WITH NUMBER AND PER CENT IN ALL OCCUPATIONS, 1900.

[From report on Occupations, Twelfth Census of the United States, 1900.]

Age.	Males in occupations exposed to organic dust.		All occupied males.	
	Number.	Per cent.	Number.	Per cent.
15 to 24 years.....	113,687	24.1	5,933,720	26.0
25 to 34 years.....	123,834	26.2	5,993,847	26.3
35 to 44 years.....	101,206	21.4	4,704,682	20.6
45 to 54 years.....	67,056	14.2	3,250,259	14.3
55 to 64 years.....	41,041	8.7	1,856,181	8.1
65 years and over.....	25,336	5.4	1,063,856	4.7
Total.....	472,160	100.0	22,802,545	100.0

This analysis as here given in the aggregate for all occupations considered would not by itself indicate that the conditions of employment in the various occupations considered predispose to any considerable degree to an excessive mortality as the result of exposure to health-injurious dust. A more detailed analysis, however, of the age distribution of employees in the separate industries considered, as given in Table II of the appendix, is much more indicative of serious health-injurious conditions in certain of the occupations, and particularly tobacco and cigar factory operatives, glove makers, bakers, leather curriers and tanners, and confectioners.

It is possible to present a combined summary of the United States census vital statistics of persons employed as millers, bakers and confectioners, cigar makers, tobacco workers, leather makers, leather workers, and boot and shoe makers. A comparison of the general death rates in these combined occupations with the corresponding death rates of occupied males generally shows a favorable general mortality experience at all ages in the combined occupations of this group. The death rate from consumption was also slightly below the normal expected, and the death rate from other respiratory diseases was 1.71 per 1,000 for the combined occupations of this group as against 1.97 for all occupied males. The details are presented in the table following.

MORTALITY FROM ALL CAUSES AMONG OCCUPATIONS EXPOSED TO ORGANIC DUST IN THE REGISTRATION STATES, COMPARED WITH THAT OF ALL OCCUPIED MALES IN THOSE STATES, 1900, BY AGE GROUPS.

[From report on Vital Statistics, Twelfth Census of the United States, 1900.]

Age.	Occupations with exposure to organic dust.			All occupied males.		
	Number employed.	Number of deaths from all causes.	Rate per 1,000 from all causes.	Number employed.	Number of deaths from all causes.	Rate per 1,000 from all causes.
15 to 24 years...	44,244	161	3.64	1,259,471	6,486	5.15
25 to 44 years.....	96,484	651	6.75	2,680,241	23,541	8.78
45 to 64 years.....	44,308	779	17.58	1,282,259	25,532	19.91
65 years and over.....	9,392	861	91.68	283,310	27,888	98.44
Total.....	194,428	2,452	^a 12.61	5,505,281	83,447	^b 15.16

^a From consumption there were 443 deaths, or a rate of 2.28. From other diseases of the respiratory system there were 333 deaths, or a rate of 1.71.

^b The rate of mortality from consumption was 2.37; from other diseases of the respiratory system, 1.97.

The occupation mortality statistics of Rhode Island for 1897 to 1906 are available for seven specific occupations of this group, and when combined return 391 deaths from all causes, of which 54 were from consumption and 43 from respiratory diseases other than consumption. The corresponding percentages were 13.8 of deaths from consumption of persons employed in occupations with exposure to general organic dust against 17.8 for occupied males generally in the State of Rhode Island. The percentage of deaths from respiratory diseases other than consumption was 11.0 for the occupations in this group against 12.5 expected.

The English vital statistics for this group of occupations are available for millers, bakers and confectioners, tobacco workers, tanners, curriers, saddle and harness makers, and shoemakers. When the returns for these occupations are combined, they exhibit a somewhat excessive death rate from all causes at ages 20 to 24, but the general death rates for these occupations are slightly favorable at the other ages. The mortality from consumption, however, was excessive at all ages, the excess being greatest at ages 20 to 24, when the consumption mortality rate per 1,000 of persons employed in occupations with exposure to general organic dust was 2.29 against 1.55 for all occupied males. The mortality from respiratory diseases other than consumption was slightly favorable at all ages except 45 to 54.

MORTALITY FROM ALL CAUSES, FROM CONSUMPTION, AND FROM OTHER DISEASES OF THE RESPIRATORY SYSTEM, IN OCCUPATIONS EXPOSED TO ORGANIC DUST, COMPARED WITH THAT OF ALL MALES IN ENGLAND AND WALES, 1900 TO 1902, BY AGE GROUPS.

[From Part II, Supplement to the Sixty-fifth Annual Report of the Registrar-General of Births, Deaths, and Marriages in England and Wales.]

Age at death.	Death rate per 1,000 due to all causes among—		Death rate per 1,000 due to consumption among—		Death rate per 1,000 due to other diseases of the respiratory system among—	
	All occu- pied males.	Occupa- tions with exposure to organic dust.	All occu- pied males.	Occupa- tions with exposure to organic dust.	All occu- pied males.	Occupa- tions with exposure to organic dust.
15 to 19 years.....	2.44	2.39	0.54	0.72	0.24	0.21
20 to 24 years.....	4.41	4.59	1.55	2.29	.48	.44
25 to 34 years.....	6.01	5.80	2.03	2.53	.77	.59
35 to 44 years.....	10.22	9.32	2.74	3.44	1.66	1.46
45 to 54 years.....	17.73	17.03	3.04	3.60	3.32	3.61
55 to 64 years.....	31.01	30.05	2.16	2.38	6.54	6.11
65 years and over	88.39	83.50	1.11	1.45	17.77	17.62

The recorded industrial insurance mortality statistics are available for thirteen specific occupations, included in this group, returning in the aggregate 7,523 deaths from all causes. Of this number 1,732, or 23.0 per cent, were from consumption. The deaths from respiratory diseases other than consumption numbered 1,050, or 14.0 per cent. The expected consumption mortality, on the basis of the mortality among males in the registration area of the United States for the seven-year period 1900 to 1906, was 14.8 per cent, and from respiratory diseases other than consumption 11.7 per cent. When the mortality from consumption and from other respiratory diseases is combined, the proportionate number of deaths among males in occupations with exposure to general organic dust is shown to be 37.0 per cent against 26.5 per cent expected.

PROPORTIONATE MORTALITY FROM CONSUMPTION IN OCCUPATIONS EXPOSED TO ORGANIC DUST, 1897 TO 1906, COMPARED WITH THAT OF ALL MALES IN THE REGISTRATION AREA OF THE UNITED STATES, 1900 TO 1906, BY AGE GROUPS.

[Figures for occupations exposed to organic dust from experience of an industrial insurance company; figures for males in registration area computed from mortality statistics of the United States census.]

Age at death.	Deaths in occupations exposed to organic dust, 1897 to 1906, due to—		Per cent of deaths due to consumption among—	
	All causes.	Consump- tion.	Occupa- tions ex- posed to organic dust.	Males in registra- tion area, 1900 to 1906.
15 to 24 years.....	680	273	40.1	27.8
25 to 34 years.....	1,060	519	49.0	31.3
35 to 44 years.....	1,191	421	35.3	23.6
45 to 54 years.....	1,257	271	21.6	15.0
55 to 64 years.....	1,502	165	11.0	8.1
65 years and over	1,833	83	4.5	2.7
Total.....	7,523	^a 1,732	23.0	^b 14.8

^a There were also 1,050 deaths from other diseases of the respiratory system, or 14.0 per cent of the deaths from all causes.
^b The per cent of deaths from other diseases of the respiratory system in the registration area was 11.7.

It is evident from the foregoing observations and statistical data relating to a representative number of employments with exposure to general organic dust that the health-injurious effects of such exposure are revealed in a general death rate, which, if not higher, is at least not decidedly lower than the general death rate for all occupied males, and also in a high proportionate mortality from consumption and other respiratory diseases, particularly at the more advanced periods of life. The statistics also indicate that general organic dust is less serious in its fatal effects than mineral or metallic dust, and as a result, the proportionate mortality from consumption and other respiratory diseases in this group of occupations is more favorable than in the group of occupations with exposure to mineral and metallic dusts.

The tabular analysis of the mortality of persons employed in occupations with exposure to organic dust indicates that the effects of such dust exposure are less serious than the corresponding effects of exposure to metallic and mineral dusts, but the consequences to health and life are sufficiently serious to demand most careful attention to the whole problem of dust prevention and removal at the point of origin, in conformity to modern methods of factory sanitation. Although the statistical evidence is more or less conflicting, and this is to be expected on account of the variations in the conditions of life and industrial methods in the different countries for which the data are available, on the whole the American mortality statistics, including industrial insurance experience, are confirmed by the official vital statistics of England and Wales and of Switzerland. All the employments included in this inquiry are occupations indispensable to human welfare and daily needs, and the ample protection of health and life in these industries is, therefore, a matter of humanitarian obligation on the part of the employer, as well as a question of self-interest on the part of the employee.

APPENDIX.

TABLE I.—NUMBER OF MALES EMPLOYED IN VARIOUS OCCUPATIONS IN THE UNITED STATES, 1900, BY AGE GROUPS.

[Computed from report on Occupations, Twelfth Census of the United States, 1900.]

Occupation.	Number of male employees in each age group.						
	15 years and over.	15 to 24 years.	25 to 34 years.	35 to 44 years.	45 to 54 years.	55 to 64 years.	65 years and over.
Draymen, hackmen, and teamsters.....	532,637	141,671	164,052	117,865	67,923	30,349	10,777
Total—Occupations with exposure to municipal dust.....	532,637	141,671	164,052	117,865	67,923	30,349	10,777
Millers	40,182	4,996	9,721	9,886	7,671	4,858	3,050
Bakers	74,263	19,567	23,446	16,876	8,424	4,137	1,813
Confectioners	21,745	5,946	6,338	4,634	2,750	1,410	667
Tobacco and cigar factory operatives.....	84,821	27,032	24,078	18,152	9,840	4,160	1,559
Leather curriers and tanners.....	40,402	9,966	11,668	9,528	5,540	2,520	1,180
Harness and saddle makers.....	39,316	6,813	9,651	8,564	6,824	4,644	2,820
Glove makers	4,416	1,571	1,169	789	503	284	100
Boot and shoe makers.....	167,015	37,796	37,763	32,777	25,504	19,028	14,147
Total—Occupations with exposure to organic dust.....	472,160	113,687	123,834	101,206	67,056	41,041	25,336
All occupied males—Continental United States	22,802,545	5,933,720	5,993,847	4,704,682	3,250,259	1,856,181	1,063,856

TABLE II.—PER CENT OF MALES EMPLOYED IN EACH AGE GROUP IN VARIOUS OCCUPATIONS IN THE UNITED STATES, 1900.

[Computed from report on Occupations, Twelfth Census of the United States, 1900.]

Occupation.	Per cent of male employees in each age group.						
	15 years and over.	15 to 24 years.	25 to 34 years.	35 to 44 years.	45 to 54 years.	55 to 64 years.	65 years and over.
Draymen, hackmen, and teamsters.....	100.0	26.6	30.8	22.1	12.8	5.7	2.0
Total—Occupations with exposure to municipal dust	100.0	26.6	30.8	22.1	12.8	5.7	2.0
Millers	100.0	12.4	24.2	24.6	19.1	12.1	7.6
Bakers	100.0	26.4	31.6	22.7	11.3	5.6	2.4
Confectioners	100.0	27.3	29.2	21.3	12.6	6.5	3.1
Tobacco and cigar factory operatives.....	100.0	31.9	28.4	21.4	11.6	4.9	1.8
Leather curriers and tanners.....	100.0	24.7	28.9	23.6	13.7	6.2	2.9
Harness and saddle makers.....	100.0	17.3	24.5	21.8	17.4	11.8	7.2
Glove makers.....	100.0	35.6	26.5	17.9	11.4	6.4	2.2
Boot and shoe makers.....	100.0	22.6	22.6	19.6	15.3	11.4	8.5
Total—Occupations with exposure to organic dust	100.0	24.1	26.2	21.4	14.2	8.7	5.4
All occupied males—Continental United States	100.0	26.0	26.3	20.6	14.3	8.1	4.7

TABLE III.—NUMBER OF DEATHS IN VARIOUS OCCUPATIONS IN THE REGISTRATION STATES OF THE UNITED STATES, 1900, BY AGE GROUPS.

[From report on Vital Statistics, Twelfth Census of the United States, 1900.]

Occupation.	Number of deaths due to—					
	All causes in each age group.				Consumption at ages 15 years and over.	Other respiratory diseases at ages 15 years and over.
	15 to 24 years.	25 to 44 years.	45 to 64 years.	65 years and over.		
Draymen, hackmen, and teamsters.....	217	1,005	548	269	485	316
Total—Occupations with exposure to municipal dust.....	217	1,005	548	269	485	316
Millers.....	3	29	34	95	12	25
Bakers and confectioners.....	41	170	166	105	98	61
Cigar makers and tobacco workers.....	34	193	172	79	122	80
Leather makers.....	13	67	72	54	52	31
Leather workers.....	8	39	88	81	28	20
Boot and shoe makers.....	62	153	247	447	131	116
Total—Occupations with exposure to organic dust.....	161	651	779	861	443	333

TABLE IV.—DEATH RATE PER 1,000 IN VARIOUS OCCUPATIONS IN THE REGISTRATION STATES OF THE UNITED STATES, 1900, BY AGE GROUPS.

[From report on Vital Statistics, Twelfth Census of the United States, 1900.]

Occupation.	Death rate per 1,000 due to—					
	All causes in each age group.				Consumption at ages 15 years and over.	Other respiratory diseases at ages 15 years and over.
	15 to 24 years.	25 to 44 years.	45 to 64 years.	65 years and over.		
Draymen, hackmen, and teamsters.....	4.7	9.9	16.7	75.3	2.6	1.7
Total—Occupations with exposure to municipal dust.....	4.7	9.9	16.7	75.3	2.6	1.7
Millers.....	5.8	10.5	15.6	164.9	2.0	4.1
Bakers and confectioners.....	4.5	7.9	23.4	105.8	2.5	1.6
Cigar makers and tobacco workers.....	5.9	14.6	31.0	120.6	4.8	3.2
Leather makers.....	3.5	7.8	19.7	94.2	3.1	1.9
Leather workers.....	3.4	7.5	23.7	94.6	2.3	1.6
Boot and shoe makers.....	2.7	3.4	11.2	77.9	1.4	1.2
Total—Occupations with exposure to organic dust.....	3.6	6.7	17.6	91.7	2.3	1.7
All occupied males, registration states ..	5.1	8.8	19.9	98.4	2.4	2.0

TABLE V.—NUMBER OF DEATHS FROM ALL CAUSES, FROM CONSUMPTION, AND FROM OTHER RESPIRATORY DISEASES AMONG OCCUPIED MALES IN RHODE ISLAND, COMPARED, 1897 TO 1906.

[From reports of the Rhode Island state board of health.]

Occupation.	Number of deaths due to—				Per cent of deaths due to—		
	All causes.	Consump- tion.	Other re- spiratory diseases.	Consump- tion and other re- spiratory diseases.	Consump- tion.	Other re- spiratory diseases.	Consump- tion and other re- spiratory diseases.
Drivers and teamsters.....	531	131	77	208	24.7	14.5	39.2
Total—Occupations with exposure to municipal dust....	531	131	77	208	24.7	14.5	39.2
Millers	14	2	2	4	14.3	14.3	28.6
Bakers.....	86	15	10	25	17.4	11.6	29.0
Confectioners	24	4	6	10	16.7	25.0	41.7
Cigar makers.....	25	5	1	6	20.0	4.0	24.0
Tanners and curriers.....	23	2	1	3	8.7	4.3	13.0
Harness and saddle makers	42	6	5	11	14.3	11.9	26.2
Shoemakers	177	20	18	38	11.3	10.2	21.5
Total—Occupations with exposure to organic dust.....	391	54	43	97	13.8	11.0	24.8
All occupied males—State of Rhode Island.....	19,314	3,429	2,420	5,849	17.8	12.5	30.3

TABLE VI.—NUMBER OF DEATHS FROM ALL CAUSES, FROM CONSUMPTION, AND FROM OTHER RESPIRATORY DISEASES AMONG OCCUPIED MALES IN RHODE ISLAND, COMPARED, 1852 TO 1906.

[From reports of the Rhode Island state board of health.]

Occupation.	Number of deaths due to—				Per cent of deaths due to—		
	All causes.	Con- sump- tion.	Other res- piratory dis- eases.	Con- sumption and other re- spiratory diseases.	Con- sump- tion.	Other res- piratory dis- eases.	Con- sumption and other re- spiratory diseases.
Teamsters	972	230	112	342	23.7	11.5	35.2
Total—Occupations with exposure to municipal dust	972	230	112	342	23.7	11.5	35.2
Millers	54	10	7	17	18.5	13.0	31.5
Bakers	221	44	19	63	19.9	8.6	28.5
Confectioners	62	15	10	25	24.2	16.1	40.3
Cigar makers.....	115	46	10	56	40.0	8.7	48.7
Tanners and curriers.....	66	6	5	11	9.1	7.6	16.7
Harness and saddle makers...	153	39	20	59	25.5	13.1	38.6
Shoemakers	716	138	64	202	19.3	8.9	28.2
Total—Occupations with exposure to organic dust	1,387	298	135	433	21.5	9.7	31.2
All occupied males in Rhode Island	55,834	11,645	6,904	18,549	20.8	12.4	33.2

TABLE VII.—YEARS OF LIFE LIVED BY OCCUPIED MALES IN CERTAIN OCCUPATIONS IN ENGLAND AND WALES DURING THE YEARS 1900 TO 1902, BY AGE GROUPS.

[From Part II, Supplement to the Sixty-fifth Annual Report of the Registrar-General of Births, Deaths, and Marriages in England and Wales.]

Occupation.	Years of life lived by males in each age group during 1900 to 1902.(a)						
	15 to 19 years.	20 to 24 years.	25 to 34 years.	35 to 44 years.	45 to 54 years.	55 to 64 years.	65 years and over.
Carmen, carriers	117,135	142,287	232,860	152,604	92,523	43,335	14,253
Coachmen, cabmen, and omnibus service	74,754	92,688	177,330	137,301	88,551	43,599	15,297
Total—Occupations with exposure to municipal dust	191,889	234,975	410,190	289,905	181,074	86,934	29,550
Millers	7,083	8,496	16,347	14,553	10,665	6,825	3,675
Bakers, confectioners	51,735	49,218	78,903	54,450	33,645	19,653	8,844
Tobacco workers	6,885	6,798	13,008	10,776	7,614	4,431	2,064
Tanners	3,582	3,975	7,050	5,550	4,314	2,559	1,185
Curriers	9,744	9,930	18,198	13,302	9,597	6,180	2,286
Saddlers, harness makers.....	11,025	10,218	18,252	14,331	10,962	7,602	3,321
Shoemakers	77,043	76,101	136,935	103,839	77,217	61,776	40,899
Total—Occupations with exposure to organic dust.....	167,097	164,736	288,693	216,801	154,014	109,026	62,274

^a The years of life as used in this table means three times the number of occupied males enumerated at the census of 1901.

TABLE VIII.—MORTALITY DUE TO ALL CAUSES AMONG OCCUPIED MALES IN CERTAIN OCCUPATIONS IN ENGLAND AND WALES, 1900 TO 1902, BY AGE GROUPS.

[From Part II, Supplement to the Sixty-fifth Annual Report of the Registrar-General of Births, Deaths, and Marriages in England and Wales.]

Occupation.	Deaths due to all causes in each age group.						
	15 to 19 years.	20 to 24 years.	25 to 34 years.	35 to 44 years.	45 to 54 years.	55 to 64 years.	65 years and over.
Carmen, carriers.....	328	611	1,562	1,998	1,889	1,580	1,537
Coachmen, cabmen, and omnibus service...	141	325	1,130	1,717	1,838	1,519	1,470
Total—Occupations with exposure to municipal dust	469	936	2,692	3,715	3,727	3,099	3,007
Millers	8	25	59	131	184	220	361
Bakers, confectioners	117	187	417	473	542	610	669
Tobacco workers	19	40	88	100	131	128	140
Tanners	9	13	27	32	65	79	106
Curriers	23	52	104	124	175	216	224
Saddlers, harness makers.....	20	48	111	140	185	223	300
Shoemakers	204	391	867	1,020	1,341	1,800	3,400
Total—Occupations with exposure to organic dust.....	400	756	1,673	2,020	2,623	3,276	5,200

TABLE IX.—MORTALITY DUE TO CONSUMPTION AMONG OCCUPIED MALES IN CERTAIN OCCUPATIONS IN ENGLAND AND WALES, 1900 TO 1902, BY AGE GROUPS.

[From Part II, Supplement to the Sixty-fifth Annual Report of the Registrar-General of Births, Deaths, and Marriages in England and Wales.]

Occupation.	Deaths due to consumption in each age group.						
	15 to 19 years.	20 to 24 years.	25 to 34 years.	35 to 44 years.	45 to 54 years.	55 to 64 years.	65 years and over.
Carmen, carriers	57	149	416	444	275	84	21
Coachmen, cabmen, and omnibus service ..	35	113	393	492	350	120	15
Total—Occupations with exposure to municipal dust	92	262	809	936	625	204	36
Miller	1	7	14	35	23	14	8
Bakers, confectioners	18	73	144	131	93	37	9
Tobacco workers	3	21	46	37	28	9	1
Tanners	4	5	8	5	18	6	.....
Curriers	9	22	36	47	31	18	5
Saddlers, harness makers	7	29	47	50	39	17	2
Shoemakers	78	221	435	440	323	159	65
Total—Occupations with exposure to organic dust	120	378	730	745	555	260	90

TABLE X.—MORTALITY DUE TO OTHER DISEASES OF THE RESPIRATORY SYSTEM AMONG OCCUPIED MALES IN CERTAIN OCCUPATIONS IN ENGLAND AND WALES, 1900 TO 1902, BY AGE GROUPS.

[From Part II, Supplement to the Sixty-fifth Annual Report of the Registrar-General of Births, Deaths, and Marriages in England and Wales.]

Occupation.	Deaths due to other diseases of the respiratory system in each age group.						
	15 to 19 years.	20 to 24 years.	25 to 34 years.	35 to 44 years.	45 to 54 years.	55 to 64 years.	65 years and over.
Carmen, carriers	30	81	267	411	411	409	364
Coachmen, cabmen, and omnibus service ..	13	34	146	271	331	330	336
Total—Occupations with exposure to municipal dust	43	115	413	682	742	739	700
Millers	1	4	12	30	44	59	109
Bakers, confectioners	15	18	44	82	100	126	138
Tobacco workers	2	4	9	24	27	23	36
Tanners	2	6	3	9	11	22	19
Curriers	2	4	15	19	36	53	38
Saddlers, harness makers	2	3	9	17	22	41	48
Shoemakers	11	35	77	135	216	342	709
Total—Occupations with exposure to organic dust	35	74	169	316	456	666	1,097

TABLE XI.—DEATH RATE PER 1,000 DUE TO ALL CAUSES AMONG OCCUPIED MALES IN CERTAIN OCCUPATIONS IN ENGLAND AND WALES, 1900 TO 1902, BY AGE GROUPS.

[From Part II, Supplement to the Sixty-fifth Annual Report of the Registrar-General of Births, Deaths, and Marriages in England and Wales.]

Occupation.	Death rate per 1,000 from all causes in each age group.						
	15 to 19 years.	20 to 24 years.	25 to 34 years.	35 to 44 years.	45 to 54 years.	55 to 64 years.	65 years and over.
Carmen, carriers	2.80	4.29	6.71	13.09	20.42	36.46	107.84
Coachmen, cabmen, and omnibus service ..	1.89	3.51	6.37	12.51	20.76	34.84	96.10
Total—Occupations with exposure to municipal dust.....	2.44	3.98	6.56	12.81	20.58	35.65	101.76
Millers	1.13	2.94	3.61	9.00	17.25	32.23	98.23
Bakers, confectioners	2.26	3.80	5.28	8.69	16.11	31.04	75.64
Tobacco workers	2.76	5.88	6.76	9.28	17.21	28.89	67.83
Tanners	2.51	3.27	3.83	5.77	15.07	30.87	89.45
Curriers	2.36	5.24	5.71	9.32	18.23	34.95	97.99
Saddlers, harness makers.....	1.81	4.70	6.08	9.77	16.88	29.33	90.33
Shoemakers	2.65	5.14	6.33	9.82	17.37	29.14	83.13
Total—Occupations with exposure to organic dust.....	2.39	4.59	5.80	9.32	17.03	30.05	83.50
All occupied males—England and Wales ...	2.44	4.41	6.01	10.22	17.73	31.01	88.39

TABLE XII.—DEATH RATE PER 1,000 DUE TO CONSUMPTION AMONG OCCUPIED MALES IN CERTAIN OCCUPATIONS IN ENGLAND AND WALES, 1900 TO 1902, BY AGE GROUPS.

[From Part II, Supplement to the Sixty-fifth Annual Report of the Registrar-General of Births, Deaths, and Marriages in England and Wales.]

Occupation.	Death rate per 1,000 due to consumption in each age group.						
	15 to 19 years.	20 to 24 years.	25 to 34 years.	35 to 44 years.	45 to 54 years.	55 to 64 years.	65 years and over.
Carmen, carriers	0.49	1.05	1.79	2.91	2.97	1.94	1.47
Coachmen, cabmen, and omnibus service ..	.47	1.22	2.22	3.58	3.95	2.75	.98
Total—Occupations with exposure to municipal dust.....	.48	1.12	1.97	3.23	3.45	2.35	1.22
Millers .....	.14	.82	.86	2.41	2.16	2.05	2.18
Bakers, confectioners .....	.35	1.48	1.83	2.41	2.76	1.88	1.02
Tobacco workers .....	.44	3.09	3.54	3.43	3.68	2.03	.48
Tanners	1.12	1.26	1.13	.90	4.17	2.34	.....
Curriers .....	.92	2.22	1.98	3.53	3.23	2.91	2.19
Saddlers, harness makers.....	.63	2.84	2.58	3.49	3.56	2.24	.60
Shoemakers	1.01	2.90	3.18	4.24	4.18	2.57	1.59
Total—Occupations with exposure to organic dust.....	.72	2.29	2.53	3.44	3.60	2.38	1.45
All occupied males—England and Wales ...	.54	1.55	2.03	2.74	3.04	2.16	1.11

TABLE XIII.—DEATH RATE PER 1,000 DUE TO OTHER DISEASES OF THE RESPIRATORY SYSTEM AMONG OCCUPIED MALES IN CERTAIN OCCUPATIONS IN ENGLAND AND WALES, 1900 TO 1902, BY AGE GROUPS.

[From Part II, Supplement to the Sixty-fifth Annual Report of the Registrar-General of Births, Deaths, and Marriages in England and Wales.]

Occupation.	Death rate per 1,000 due to other diseases of the respiratory system in each age group.						
	15 to 19 years.	20 to 24 years.	25 to 34 years.	35 to 44 years.	45 to 54 years.	55 to 64 years.	65 years and over.
Carmen, carriers	0.26	0.57	1.15	2.69	4.44	9.44	25.54
Coachmen, cabmen, and omnibus service..	.17	.37	.82	1.97	3.74	7.57	21.97
Total—Occupations with exposure to municipal dust.....	.22	.49	1.01	2.35	4.10	8.50	23.69
Millers .....	.14	.47	.73	2.06	4.13	8.64	29.66
Bakers, confectioners .....	.29	.37	.56	1.51	2.97	6.41	15.60
Tobacco workers .....	.29	.59	.69	2.23	3.55	5.19	17.44
Tanners .....	.56	1.51	.43	1.62	2.55	8.60	16.03
Curriers .....	.21	.40	.82	1.43	3.75	8.58	16.62
Saddlers, harness makers .....	.18	.29	.49	1.19	2.01	5.39	14.45
Shoemakers .....	.14	.46	.56	1.30	2.80	5.54	17.34
Total—Occupations with exposure to organic dust.....	.21	.45	.59	1.46	2.96	6.11	17.62
All occupied males—England and Wales....	.24	.48	.77	1.66	3.32	6.54	17.77

TABLE XIV.—YEARS OF LIFE LIVED BY OCCUPIED MALES IN CERTAIN OCCUPATIONS IN SCOTLAND DURING THE YEARS 1900 TO 1902, BY AGE GROUPS.

[From Supplement to the Forty-eighth Annual Report of the Registrar-General of Births, Deaths, and Marriages in Scotland.]

Occupation.	Years of life lived by males in each age group during 1900 to 1902. (a)			
	15 to 24 years.	25 to 44 years.	45 to 64 years.	65 years and over.
Carters, carriers, van men	35,235	55,743	21,111	2,559
Total—Occupations with exposure to municipal dust ..	35,235	55,743	21,111	2,559
Millers	1,722	3,816	2,646	702
Bakers, confectioners	22,509	26,895	10,866	1,452
Skinners, tanners, curriers.....	2,547	4,698	2,688	417
Saddlers, harness makers.....	2,214	2,604	1,464	273
Boot and shoe makers	9,966	20,364	16,557	4,668
Total—Occupations with exposure to organic dust.....	38,958	58,377	34,221	7,512

a The years of life used in this table means three times the number of occupied males enumerated at the census of 1901.

TABLE XV.—MORTALITY DUE TO ALL CAUSES AMONG OCCUPIED MALES IN CERTAIN OCCUPATIONS IN SCOTLAND, 1900 TO 1902, BY AGE GROUPS.

[From Supplement to the Forty-eighth Annual Report of the Registrar-General of Births, Deaths, and Marriages in Scotland.]

Occupation.	Deaths due to all causes in each age group.			
	15 to 24 years.	25 to 44 years.	45 to 64 years.	65 years and over.
Carters, carriers, van men	188	496	631	449
Total—Occupations with exposure to municipal dust..	188	496	631	449
Millers	6	22	80	110
Bakers, confectioners	81	215	349	241
Skinners, tanners, curriers	8	34	67	67
Saddlers, harness makers	11	21	40	38
Boot and shoe makers	66	218	540	681
Total—Occupations with exposure to organic dust.....	172	510	1,076	1,137

TABLE XVI.—DEATH RATE PER 1,000 DUE TO ALL CAUSES AMONG OCCUPIED MALES IN CERTAIN OCCUPATIONS IN SCOTLAND, 1900 TO 1902, BY AGE GROUPS.

[From Supplement to the Forty-eighth Annual Report of the Registrar-General of Births, Deaths, and Marriages in Scotland.]

Occupation.	Death rate per 1,000 due to all causes in each age group.			
	15 to 24 years.	25 to 44 years.	45 to 64 years.	65 years and over.
Carters, carriers, van men	5.34	8.90	29.89	175.46
Total—Occupations with exposure to municipal dust ..	5.34	8.90	29.89	175.46
Millers	3.48	5.77	30.23	156.70
Bakers, confectioners	3.60	7.99	32.12	165.98
Skinners, tanners, curriers	3.14	7.24	24.93	160.67
Saddlers, harness makers	4.97	8.06	27.32	139.19
Boot and shoe makers	6.62	10.71	32.61	145.89
Total—Occupations with exposure to organic dust	4.42	8.74	31.44	151.86
All occupied males—Scotland		9.32	26.82	

TABLE XVII.—NUMBER AND PER CENT OF DEATHS DUE TO CONSUMPTION AND TO OTHER DISEASES OF THE RESPIRATORY SYSTEM IN CERTAIN OCCUPATIONS IN SCOTLAND, 1900 TO 1902, AGES 25 TO 64 YEARS.

[From Supplement to the Forty-eighth Annual Report of the Registrar-General of Births, Deaths, and Marriages in Scotland.]

Occupation.	Deaths due to consumption and to other diseases of the respiratory system.									
	Number due to—					Per cent of deaths due to—				
	Con-sump-tion.	Bron-chitis.	Pneu-monia.	Other respira-tory dis-eases.	Con-sump-tion and re-spirato-ry dis-eases.	Con-sump-tion.	Bron-chitis.	Pneu-monia.	Other respira-tory dis-eases.	Con-sump-tion and re-spirato-ry dis-eases.
Carters, carriers, van men	158	82	159	15	414	14.0	7.3	14.1	1.3	36.7
Total—Occu-pations with ex-posure to municipal dust	158	82	159	15	414	14.0	7.3	14.1	1.3	36.7
Millers	11	13	9	2	35	10.8	12.7	8.8	2.0	34.3
Bakers, confection-ers	104	45	62	8	219	18.4	8.0	11.0	1.4	38.8
Skinners, tanners, curriers	23	10	10	1	44	22.8	9.9	9.9	1.0	43.6
Saddlers, harness makers	10	1	5	1	17	16.4	1.6	8.2	1.6	27.9
Boot and shoe makers	146	60	75	2	283	19.3	7.9	9.9	.3	37.3
Total—Occu-pations with ex-posure to organic dust	294	129	161	14	598	18.5	8.1	10.2	.9	37.7

TABLE XVIII.—DEATH RATE PER 1,000 DUE TO CONSUMPTION AMONG OCCUPIED MALES IN CERTAIN OCCUPATIONS IN SWITZERLAND, 1879 TO 1890, BY AGE GROUPS.

[From Vital Statistics of Switzerland, 1871 to 1890, Part III.]

Occupation.	Death rate per 1,000 due to consumption in each age group.						
	15 to 19 years.	20 to 29 years.	30 to 39 years.	40 to 49 years.	50 to 59 years.	60 to 69 years.	70 years and over.
Street, waterworks, and sewer employees.	1.10	1.99	2.78	3.39	2.88	2.92	1.60
Millers	1.23	1.42	3.02	5.18	6.49	5.47	7.11
Bakers.....	1.30	2.75	4.72	3.96	4.75	5.92	7.61
Confectioners.....	2.34	6.19	6.36	3.58	6.00	9.38	13.51
Tobacco workers and cigar makers.....	.83	2.00	3.35	4.22	4.01	3.55	.....
Saddlers.....	2.10	4.24	6.77	3.61	6.83	10.01	4.33
Shoemakers	1.41	3.52	3.95	4.10	5.35	5.19	4.22
All occupied males—Switzerland.....	1.30	3.04	3.66	3.65	3.52	3.25	1.84

TABLE XIX.—DEATHS DUE TO ALL CAUSES AMONG OCCUPIED MALES IN CERTAIN OCCUPATIONS IN THE UNITED STATES, 1897 TO 1906, BY AGE GROUPS.

[From experience of an industrial insurance company.]

Occupation.	Deaths due to all causes in each age group.						
	15 years and over.	15 to 24 years.	25 to 34 years.	35 to 44 years.	45 to 54 years.	55 to 64 years.	65 years and over.
Street cleaners	180	.....	18	37	47	45	33
Cabmen, coachmen, and hackmen	651	39	136	154	149	105	68
Drivers, truckmen	3,850	386	1,024	974	660	468	338
Total—Occupations with exposure to municipal dust.....	4,681	425	1,178	1,165	856	618	439
Grain handlers and elevator men.....	24	1	7	5	7	2	2
Millers	256	7	8	27	39	64	111
Bakers	1,357	112	201	259	248	250	287
Confectioners	306	51	52	62	39	56	46
Cigar makers and packers	1,530	131	267	281	325	284	242
Tobacco workers.....	141	28	31	26	21	21	14
Tobacco and cigar dealers	196	14	34	35	29	40	44
Tanners, beamers, and curriers	478	41	44	66	81	100	146
Harness makers and saddlers	510	34	44	60	86	131	155
Leather workers.....	641	92	154	155	99	79	62
Glove cutters and makers.....	27	6	2	4	7	2	6
Boot and shoe makers.....	1,930	139	185	179	252	467	708
Button makers	127	24	31	32	24	6	10
Total—Occupations with exposure to organic dust.....	7,523	680	1,060	1,191	1,257	1,502	1,833

TABLE XX.—DEATHS DUE TO CONSUMPTION AMONG OCCUPIED MALES IN CERTAIN OCCUPATIONS IN THE UNITED STATES, 1897 TO 1906, BY AGE GROUPS.

[From experience of an industrial insurance company.]

Occupation.	Deaths due to consumption in each age group.						
	15 years and over.	15 to 24 years.	25 to 34 years.	35 to 44 years.	45 to 54 years.	55 to 64 years.	65 years and over.
Street cleaners	33	.....	8	13	7	3	2
Cabmen, coachmen, and hackmen.....	163	19	58	52	22	11	1
Drivers, truckmen	999	126	400	313	113	35	12
Total—Occupations with exposure to municipal dust.....	1,195	145	466	378	142	49	15
Grain handlers and elevator men.....	5	.....	1	2	1	.....	1
Millers	40	2	7	8	11	9	3
Bakers	277	43	86	75	43	23	7
Confectioners	68	13	22	19	5	6	3
Cigar makers and packers.....	442	57	147	119	67	36	16
Tobacco workers.....	49	10	15	11	8	4	1
Tobacco and cigar dealers	43	5	15	12	4	4	3
Tanners, beamers, and curriers.....	89	21	19	18	16	7	8
Harness makers and saddlers.....	89	15	21	20	20	11	2
Leather workers.....	206	35	77	55	29	9	1
Glove cutters and makers.....	5	2	.....	1	.....	1	1
Boot and shoe makers.....	371	58	93	69	61	54	36
Button makers.....	48	12	16	12	6	1	1
Total—Occupations with exposure to organic dust.....	1,732	273	519	421	271	165	83

TABLE XXI.—PER CENT OF DEATHS DUE TO CONSUMPTION AMONG OCCUPIED MALES IN CERTAIN OCCUPATIONS IN THE UNITED STATES, 1897 TO 1906, BY AGE GROUPS.

[From experience of an industrial insurance company.]

Occupation.	Per cent of deaths due to consumption in each age group.						
	15 years and over.	15 to 24 years.	25 to 34 years.	35 to 44 years.	45 to 54 years.	55 to 64 years.	65 years and over.
Street cleaners	18.3	.....	44.4	35.1	14.9	6.7	6.1
Cabmen, coachmen, and hackmen.....	25.0	48.7	42.6	33.8	14.8	10.5	1.5
Drivers, truckmen	25.9	32.6	39.1	32.1	17.1	7.5	3.6
Total—Occupations with exposure to municipal dust.....	25.5	34.1	39.6	32.4	16.6	7.9	3.4
Grain handlers and elevator men.....	20.8	.....	14.3	40.0	14.3	.....	50.0
Millers	15.6	28.6	87.5	29.6	28.2	14.1	2.7
Bakers	20.4	38.4	42.8	29.0	17.3	9.2	2.4
Confectioners	22.2	25.5	42.3	30.6	12.8	10.7	6.5
Cigar makers and packers.....	28.9	43.5	55.1	42.3	20.6	12.7	6.6
Tobacco workers	34.8	35.7	48.4	42.3	38.1	19.0	7.1
Tobacco and cigar dealers	21.9	35.7	44.1	34.3	13.8	10.0	6.8
Tanners, beamers, and curriers.....	18.6	51.2	43.2	27.3	19.8	7.0	5.5
Harness makers and saddlers	17.5	44.1	47.7	33.3	23.3	8.4	1.3
Leather workers.....	32.1	38.0	50.0	35.5	29.3	11.4	1.6
Glove cutters and makers.....	18.5	33.3	.....	25.0	.....	50.0	16.7
Boot and shoe makers.....	19.2	41.7	50.3	38.5	24.2	11.6	5.1
Button makers	37.8	50.0	51.6	37.5	25.0	16.7	10.0
Total—Occupations with exposure to organic dust.....	23.0	40.1	49.0	35.3	21.6	11.0	4.5

TABLE XXII.—NUMBER AND PER CENT OF DEATHS DUE TO DISEASES OF THE RESPIRATORY SYSTEM OTHER THAN CONSUMPTION AMONG OCCUPIED MALES IN CERTAIN OCCUPATIONS IN THE UNITED STATES, 1897 TO 1906.

[From experience of an industrial insurance company.]

Occupation.	Deaths due to respiratory diseases other than consumption.									
	Number due to—					Per cent of deaths due to—				
	All re- spira- tory dis- eases other than con- sump- tion.	Asth- ma.	Bron- chitis.	Pneu- monia.	Other respira- tory dis- eases.	All re- spira- tory dis- eases other than con- sump- tion.	Asth- ma.	Bron- chitis.	Pneu- monia.	Other respira- tory dis- eases.
Street cleaners....	33	3	5	23	2	18.3	1.6	2.8	12.8	1.1
Coachmen, cab- men, and hack- men.....	122	6	10	94	12	18.6	.9	1.5	14.4	1.8
Drivers, truckmen.	632	27	56	483	66	16.4	.7	1.5	12.5	1.7
Total—Occu- pations with expo- sure to mu- nicipaldust.	787	36	71	600	80	16.8	.8	1.5	12.8	1.7
Grain handlers and elevator men.	1	.....	.....	1	.....	4.2	.....	.....	4.2	.....
Millers.....	41	7	4	29	1	16.0	2.7	1.6	11.3	.4
Bakers.....	185	17	23	124	21	13.6	1.3	1.7	9.1	1.5
Confectioners.....	54	3	4	40	7	17.7	1.0	1.3	13.1	2.3
Cigarmakers and packers.....	180	16	22	118	24	11.6	1.0	1.4	7.7	1.5
Tobacco workers...	14	3	3	7	1	9.9	2.1	2.1	5.0	.7
Tobacco and cigar dealers.....	37	6	7	23	1	18.9	3.1	3.6	11.7	.5
Tanners, beamers, and curriers.....	91	5	9	65	12	19.0	1.0	1.9	13.6	2.5
Harnessmakers and saddlers.....	61	4	9	41	7	11.9	.7	1.8	8.0	1.4
Leather workers...	89	6	11	62	10	13.9	.9	1.7	9.7	1.6
Glove cutters and makers.....	5	.....	2	3	.....	18.5	.....	7.4	11.1	.....
Boot and shoe makers.....	278	30	41	173	34	14.4	1.6	2.1	9.0	1.8
Buttonmakers.....	14	1	.....	11	2	11.0	.8	.....	8.6	1.6
Total—Occu- pations with expo- sure to or- ganic dust..	1,050	98	135	697	120	14.0	1.3	1.8	9.3	1.6

TABLE XXIII.—DEATHS DUE TO ALL CAUSES, TO CONSUMPTION, AND TO OTHER DISEASES OF THE RESPIRATORY SYSTEM AMONG MALES IN THE REGISTRATION AREA OF THE UNITED STATES, 1900 TO 1906, BY AGE GROUPS.

[From reports on mortality, Bureau of the Census.]

Age at death.	Deaths due to all causes.	Deaths due to con- sumption.		Deaths due to other diseases of the re- spiratory system.	
		Number.	Per cent of deaths from con- sumption.	Number.	Per cent of deaths from other respiratory diseases.
15 to 24 years	134,700	37,495	27.8	13,010	9.7
25 to 34 years	186,530	58,424	31.3	20,298	10.9
35 to 44 years	205,930	48,500	23.6	25,655	12.5
45 to 54 years	205,497	30,781	15.0	25,869	12.6
55 to 64 years	218,151	17,707	8.1	26,575	12.2
65 years and over.....	435,228	11,949	2.7	50,603	11.6
Total	1,386,036	204,856	14.8	162,010	11.7

RECENT REPORTS OF STATE BUREAUS OF LABOR STATISTICS. MAINE.

Twenty-second Annual Report of the Bureau of Industrial and Labor Statistics for the State of Maine, 1908. Thomas J. Lyons, Commissioner. xiv, 459 pp.

The following subjects are presented in this report: Women and children in the textile industry, 83 pages; rural conditions in Maine, 215 pages; employers' liability, 40 pages; shorter workday for women and children, 16 pages; directory of labor organizations, 25 pages; farm crops in Maine, 13 pages; constitutional amendment, 5 pages; factories, mills, and shops built during 1908, 4 pages; strikes and labor difficulties, 33 pages; report of the inspector of factories, workshops, mines, and quarries, 11 pages.

WOMEN AND CHILDREN IN THE TEXTILE INDUSTRY.—Under this title are given the results of an investigation into the conditions surrounding the employment of women and children in the mills of Lewiston, Auburn, Biddeford, and Saco. The work of the women and children is described in detail, and mention is made of the various agencies existing for the improvement of conditions.

EMPLOYERS' LIABILITY.—In this section is given a history of the legislation enacted in this and other countries upon the subject of the liability of employers for injuries occurring to their employees and the text of legislation proposed for enactment in the State of Maine.

SHORTER WORKDAY FOR WOMEN AND CHILDREN.—Reasons are given under this head for the restriction of the hours of women and children. Reference is made to earlier legislation, and the decisions of the courts are given in regard to its constitutionality.

FACTORIES, MILLS, AND SHOPS BUILT.—Returns show that in 1908, in 86 towns, 95 buildings were erected or enlarged, remodeled, etc., at a total cost of \$1,448,500. These improvements provided for 3,518 additional employees. A summary of improvements of this character is presented for each of the ten years, 1899 to 1908.

NUMBER AND AGGREGATE COST OF FACTORIES, MILLS, AND SHOPS BUILT OR ENLARGED, ETC., AND ADDITIONAL EMPLOYEES, BY YEARS, 1899 TO 1908.

Year.	Number of towns.	Number of build-ings.	Aggregate cost.	New em- ployees.
1899	103	138	\$6,800,700	4,990
1900	114	167	2,174,825	5,539
1901	94	121	5,638,200	6,337
1902	91	129	2,776,930	5,017
1903	96	124	1,436,900	3,343
1904	91	113	1,175,500	3,276
1905	93	114	2,303,410	3,329
1906	104	131	2,637,500	3,674
1907	95	133	4,140,960	3,566
1908	86	95	1,448,500	3,518

STRIKES AND LABOR DIFFICULTIES.—Under this head are given accounts, arranged by towns, of the minor labor difficulties occurring during the year 1908. Separate accounts are given of the more serious strikes in the paper and wood pulp industry.

CHILD LABOR.—In the report on factory inspection a table is presented, in which it is shown that the number of children working under certificates in certain manufacturing establishments of the State was 1,111 in 1907 and 1,357 in 1908.

MARYLAND.

Seventeenth Annual Report of the Bureau of Statistics and Information of Maryland, 1908. Charles J. Fox, Chief. 532 pp.

The following are the subjects presented in this report: The State of Maryland, its industries and resources, 178 pages; child labor, 52 pages; factory inspection, 88 pages; free employment agency, 8 pages; prices of grain, 2 pages; cost of living, 8 pages; strikes and lockouts, 8 pages; in labor circles, 12 pages; special investigation, 4 pages; new incorporations, 23 pages; immigration, 7 pages; proceedings of the twenty-fourth annual convention of officials of bureaus of labor statistics, 9 pages; financial statement, 1 page; gazetteer, 109 pages.

CHILD LABOR.—In this chapter is given the results of the enforcement of the child-labor law during the year 1908. To children between 12 and 16 years of age 5,913 labor permits were issued—3,426 to boys and 2,487 to girls. Of this total, 142 labor permits were issued to colored boys and 43 to colored girls. In Baltimore city the labor permits issued numbered 5,177—2,977 to boys and 2,200 to girls, of which 127 were to colored boys and 38 to colored girls. Applications for permits to the number of 704 were refused. The arrests made during 1908 for the violation of the law numbered 9.

A summary of the work of the various district inspectors shows that there were employed in the manufacturing establishments and factories of various kinds inspected in Baltimore city 2,030 males and

1,895 females under 16 years of age. In wholesale and retail stores and in offices there were employed 1,348 males and 526 females under 16 years of age. The average wages for the whole city for children engaged in the manufacturing industries was \$3.64 per week, and for children employed in stores, offices, etc., \$3.11 per week.

FREE EMPLOYMENT AGENCY.—During 1908, the year covered by this report, there were 425 applications for positions, 378 by males and 47 by females. Of the applicants, 77 were laborers, 46 were clerks, 34 were farm hands, and the remainder were distributed among 73 other occupations. Applications for help numbered 64, of which 33 were for male help and 31 for female help. There were 29 positions filled, 24 by males and 5 by females. As to character of positions filled, 21 were farm hands and 4 were cooks.

COST OF LIVING.—Under this title is given a table showing the average monthly retail prices of the principal articles of food and fuel in 1908, compiled from prices quoted in the daily papers of Baltimore. In conjunction with this there are presented for 536 persons engaged in 22 different occupations, in 1908, hours worked and earnings per day, days worked during the year, and average yearly earnings. For persons engaged in a part of the occupations the average yearly earnings for 1908 are placed in comparison with those for 1907, 1906, and 1905.

STRIKES AND LOCKOUTS.—There are given for the year 1908 statistics of 16 strikes, which threw out of employment 2,521 persons (2,024 males and 497 females), with an estimated wage loss of \$41,424. Of the 16 strikes 4 were ordered by organizations and 12 were not; 5 were for increase of wages, 5 were for change in system of work, 2 were against reduction of wages, and 4 were for other causes; 8 strikes were successful, 2 were partly successful, and 6 were unsuccessful. So far as could be ascertained, the sum of \$1,420 was expended in assisting those on strike. No lockouts were reported for the year.

IN LABOR CIRCLES.—Under this caption is presented the returns for 1908 from 50 labor organizations, having a reported membership of 7,271. A list of the unions reporting is given, with name of each organization, name and address of secretary, membership, hours of labor per day, and minimum rate of wages. The lowest reported union wage was \$1.17 per day for bindery women, while the highest was \$5 per day for bricklayers. Of the total unions, 25 reported the hours of labor as 8 per day, 2 as 8½ per day, 12 as 9 per day, 4 as 10 per day, 3 reported hours from 10 to 13 per day, and 4 made no report.

UNEMPLOYMENT.—As a result of a special investigation, it was found that in the month of September, 1908, but 36,824 persons were employed in 261 mills and factories in the State. When working full

time the same mills employed a total of 56,061 persons. It was thus shown that 34 per cent of the usual force was out of employment at that time. The rate of wages paid and the cost of living were found to be practically the same as in the previous year.

IMMIGRATION.—For the year ending December 31, 1908, 8,472 aliens, exclusive of transits, were admitted at the port of Baltimore. Of this number only 1,330 were destined to Maryland.

MICHIGAN.

Twenty-sixth Annual Report of the Bureau of Labor and Industrial Statistics, including the Sixteenth Annual Report of State Inspection of Factories, 1909. Richard H. Fletcher, Commissioner. 415 pp.

This report consists of two sections, the second section (318 pages) being devoted to inspection of factories, stores, hotels, tenement shops, etc. In the first section, which relates to labor and industrial statistics, the following subjects are presented: Labor laws, 31 pages; description of a trip through the copper and iron district of Michigan, 6 pages; manufacture of paper, 3 pages; free employment bureaus, 42 pages; manufacture of beet sugar, 4 pages.

PAPER MANUFACTURE.—In the year ending June 30, 1908, there were manufactured in the State 243,951 tons of paper of various grades, valued at \$12,972,357. This was the output of 36 plants, representing an invested capital of \$9,550,500. The sum of \$2,375,658 was paid out in wages to 4,507 employees, of whom 3,766 were males receiving an average of \$1.81 per day, and 741 were females receiving an average of \$1.09 per day.

FREE EMPLOYMENT BUREAUS.—Under this title is presented a detailed report of the work done in the five free employment bureaus of the State. The bureau at Jackson was opened during 1908.

The following table summarizes the work done at the Detroit, Grand Rapids, Kalamazoo, and Saginaw bureaus for the year ending November 30, 1908, and at the Jackson bureau for the period August 1 to November 30, 1908:

OPERATIONS OF FREE PUBLIC EMPLOYMENT OFFICES, YEAR ENDING NOVEMBER 30, 1908.

City.	Situations wanted.		Help wanted.		Positions secured.	
	Males.	Females.	Males.	Females.	Males.	Females.
Detroit.....	5,408	1,887	5,361	2,275	4,951	1,773
Grand Rapids.....	2,844	2,231	1,511	1,550	1,453	1,490
Jackson.....	^a 521	^a 353	^a 198	^a 258	^a 160	^a 205
Kalamazoo.....	4,300	1,412	1,617	973	1,339	666
Saginaw.....	2,992	632	1,709	777	1,430	526
Total.....	16,065	6,515	10,396	5,833	9,333	4,660

^aAugust 1 to November 30, 1908.

BEET-SUGAR MANUFACTURE.—In the beet-sugar industry 16 factories were in operation during the year 1908, the same number as in 1907. These 16 factories represent an aggregate investment of \$10,440,000. There were employed in the plants 4,205 persons, at an average daily wage of \$2.11. The number of tons of beets grown in 1908 was approximately 612,000.

THE COAL INDUSTRY.—In this industry there were 33 mines in operation during the year 1908, as compared with 34 mines during the year 1907. A condensed summary of the operations of the mines for the two years is presented in the following table:

COAL MINE STATISTICS, 1907 AND 1908.

Item.	Year.	
	1907.	1908.
Mines in operation	34	33
Average number of employees	2,881	3,087
Average hours worked per day	8	7.8
Average days worked per month	20.4	20.2
Average daily wages	\$3.24	\$3.02
Tons of coal mined	1,898,426	1,839,927
Average cost of mining per ton	\$1.64½	\$1.67

In 30 mines 101 accidents were reported—6 fatal, 13 serious, 35 severe, 46 slight, and 1 not reported as to extent of injury.

NEW JERSEY.

Thirty-first Annual Report of the Bureau of Statistics of Labor and Industries of New Jersey for the year ending October 31, 1908.

Winton C. Garrison, Chief. xiv, 390 pp.

This report consists of 3 parts, in which the following subjects are presented: Statistics of manufactures, 124 pages; the industrial depression of 1907–8, 72 pages; steam railroads, 12 pages; cost of living, 10 pages; fruit and vegetable canning, 10 pages; industrial chronology, 162 pages.

STATISTICS OF MANUFACTURES.—This presentation of the statistics of manufactures is based on returns for the year 1907 from 2,152 establishments, 2,070 representing 88 specified industries and 82 grouped as unclassified. None of the establishments considered employed fewer than 10 persons or had invested capital of less than \$5,000. The facts are set out in ten tables, which show by industries, character of establishment, management (whether corporate or private), amount of capital and various forms in which it is invested, value of stock or materials used and of goods produced, number of wage-earners (men, women, and children under 16 years of age) and

wages and earnings, days in operation during the year and hours worked per day and per week, percentage of business done of total productive capacity, and character and measure of power used.

The returns show that of the 2,152 establishments reporting, 1,384 (in 1,381 of which were 75,452 stockholders) were under the corporate form of ownership and management, and 768 (with 1,339 partners and proprietors) were owned and managed by partnerships and private individuals. Capital invested (by 2,149 establishments) showed an aggregate of \$629,549,849, value of materials or stock used (by 2,145 establishments) an aggregate of \$462,854,716, and value of products or goods made (by 2,142 establishments) an aggregate of \$773,186,299. The total paid out in wages amounted to \$144,740,069. During the year there was an average of 280,280 wage-earners employed, 209,859 males 16 years of age and over, 64,613 females 16 years of age and over, and 5,808 children under 16 years of age. Under normal conditions the average number of hours worked per day in the 2,152 establishments was 9.60, and the average number of hours worked per week 55.83. The average number of days in operation during the year was 285.92, and the average proportion of business done of total productive capacity was 77.96 per cent.

The table following presents the number and per cent of males and females 16 years of age and over and of children under 16 years of age employed in 1907 in all industries (2,152 establishments) at each specified weekly rate of wages:

NUMBER AND PER CENT OF MALES AND FEMALES 16 YEARS OF AGE AND OVER AND OF CHILDREN UNDER 16 YEARS OF AGE IN ALL INDUSTRIES (2,152 ESTABLISHMENTS), RECEIVING EACH CLASSIFIED WEEKLY RATE OF WAGES, 1907.

Classified weekly wages.	Number.				Per cent.			
	Males 16 years of age and over.	Females 16 years of age and over.	Children under 16 years of age.	Total.	Males 16 years of age and over.	Females 16 years of age and over.	Children under 16 years of age.	Total.
Under \$3.....	1,148	1,430	845	3,423	0.5	2.1	12.8	1.1
\$3 and under \$4.....	2,681	4,143	2,744	9,568	1.2	6.0	41.5	3.2
\$4 and under \$5.....	5,499	9,312	1,878	16,689	2.5	13.5	28.4	5.6
\$5 and under \$6.....	6,995	12,720	796	20,511	3.1	18.5	12.1	6.8
\$6 and under \$7.....	8,911	12,315	254	21,480	4.0	17.9	3.9	7.2
\$7 and under \$8.....	11,447	9,648	55	21,150	5.1	14.0	.8	7.0
\$8 and under \$9.....	15,899	6,623	33	22,555	7.1	9.6	.5	7.5
\$9 and under \$10....	33,351	4,704	.....	38,055	14.8	6.8	.....	12.7
\$10 and under \$12....	36,505	4,345	.....	40,850	16.2	6.3	.....	13.6
\$12 and under \$15....	39,440	2,739	.....	42,179	17.5	4.0	.....	14.0
\$15 and under \$20....	42,321	785	.....	43,106	18.8	1.2	.....	14.4
\$20 and under \$25....	13,368	82	.....	13,450	6.0	.1	.....	4.5
\$25 and over	7,265	8	.....	7,273	3.2	.....	.....	2.4
Total.....	224,830	68,854	6,605	300,289	100.0	100.0	100.0	100.0

The following comparative table shows for selected industries, for the years 1906 and 1907, the average number of persons employed per industry and the average yearly earnings per employee:

AVERAGE NUMBER OF EMPLOYEES PER INDUSTRY AND AVERAGE YEARLY EARNINGS PER EMPLOYEE, 1906 AND 1907, BY INDUSTRIES.

Industry.	Average employees per industry.		Average yearly earnings per employee.	
	1906.	1907.	1906.	1907.
Artisans' tools	2,445	2,516	\$585.24	\$590.55
Boilers, steam	1,996	1,875	629.14	609.64
Brewery products	2,065	2,063	898.31	924.93
Brick and terra cotta	7,419	6,759	469.02	462.26
Chemical products	6,839	7,196	513.49	529.91
Cigars and tobacco	8,376	9,061	294.78	319.22
Drawn wire and wire cloth	1,867	8,116	596.21	532.01
Electrical appliances	6,739	6,353	519.52	558.57
Furnaces, ranges, and heaters	1,915	1,902	686.32	721.08
Glass, window and bottle	6,190	6,624	569.60	587.98
Hats, men's	5,832	5,416	581.53	647.31
Jewelry	3,482	3,435	682.31	654.23
Leather, tanning and finishing	5,722	5,381	617.59	563.75
Lamps, electric and other	2,317	3,281	433.75	429.96
Machinery	24,393	24,959	631.37	636.70
Metal goods	6,751	7,076	450.45	459.27
Oils	3,753	4,074	644.10	684.39
Paper	2,419	2,860	502.27	519.08
Pottery	4,833	4,947	629.95	619.27
Rubber products, hard and soft	6,280	6,448	489.76	503.16
Shipbuilding	3,822	4,927	677.56	696.84
Silk goods, broad and ribbon	21,543	20,055	434.72	473.89
Steel and iron, structural	3,429	3,292	627.34	631.17
Steel and iron, forging	2,882	3,242	649.35	631.13
Woolen and worsted goods	8,965	9,989	355.30	393.19
Twenty-five industries	152,274	161,847	534.42	546.23
Other industries	107,798	118,433	465.76	477.47
All industries	260,072	280,280	505.96	517.24

INDUSTRIAL DEPRESSION.—Returns from 1,114 establishments distributed through 59 industries indicate that owing to the industrial depression late in 1907, 8,630 contracts, involving \$8,504,424, were canceled, necessitating the discharge of 40,181 wage-earners, or 23.7 per cent of the usual force.

STEAM RAILROADS.—For the year ending June 30, 1908, the 7 railroads in the State employed 42,514 persons for an average of two hundred and ninety-six days per person, each working an average of 10.4 hours per day. The total paid in wages amounted to \$27,940,975, the average wages per day being \$2.22 and the average yearly earnings per employee \$657.22. Six of the companies reported the number of employees injured during the year as 1,827, the injuries of 116 resulting in death.

COST OF LIVING.—This is a continuation of the presentation of previous years, and shows the retail prices of 50 items of food and 2 other commodities (common soap and kerosene oil) in the principal markets in all counties of the State, in the month of June, 1908.

Comparisons with retail prices in 1907 and in 1898 (the year the investigation was begun) are also given.

Taking the list of commodities together, the prices in 1908, as compared with the prices in 1907, show a decrease of but 2.99 per cent, while taken in comparison with the prices in 1898 they show an increase of 24.08 per cent.

FRUIT AND VEGETABLE CANNING.—In 1907 there were 42 canneries from which returns were received. Invested capital to the amount of \$775,996 and wages paid to the amount of \$429,442 were reported by the canneries. The 42 canneries gave employment to 4,901 wage-earners—2,078 males and 2,823 females. The selling value of the product amounted to \$2,263,361.

INDUSTRIAL CHRONOLOGY.—This record is for the year ending September 30, 1908. During the period there were 50 new buildings erected and equipped for manufacturing purposes and 27 old plants more or less enlarged; 9 manufacturing plants were permanently closed and 53 closed for a period ranging from one to ten months; 86 establishments suffered from fire, the losses amounting to \$1,383,889, all but a small part of which was covered by insurance; there were 9 instances in which employees received an increase in wages, and 24 firms reduced the hours of weekly labor; 1,075 wage-earners (279 being railroad employees) were injured while at work, of which number 234 (95 being railroad employees) died from the injuries received; 57 strikes of greater or less duration occurred, 11 being against reduction of wages, 9 for increase of wages, 9 against employment of nonunion men, and the remainder for various other causes. There were 5 new labor unions organized during the chronological period covered.

NORTH DAKOTA.

Tenth Biennial Report of the Commissioner of Agriculture and Labor for the term ending June 30, 1908. W. C. Gilbreath, Commissioner. 101 pp.

This report, which was compiled from the records of the assessors and other county officers, presents statistics on the following subjects: Statistics of agriculture, 40 pages; valuation of property, 16 pages; dairy industry, 4 pages; live stock, 4 pages; orchards and fruit, 2 pages; coal mines, 6 pages; vital statistics, 2 pages; farm labor, 2 pages.

FARM LABOR.—Tables show for each county the number of male and female employees reported in 1906 and 1907, their average monthly wages, and the total amount paid in wages. The lowest average monthly wages reported in any county in 1907 was \$13.18

for males and \$3 for females; the highest average was \$40 for males and \$22.67 for females.

COAL MINES.—Returns are given from the coal mines of the State for each year of the period covered. In 1907, 46 mines reported the employment of 310 persons and the production of 303,025 tons of coal.

OREGON.

Third Biennial Report of the Bureau of Labor Statistics and Inspector of Factories and Workshops of the State of Oregon, 1907-8.
O. P. Hoff, Commissioner. 200 pp.

This report presents a variety of subjects pertaining directly and indirectly to labor and industrial conditions.

LABOR ORGANIZATIONS.—Reports were received from 108 unions, having a total membership of 11,581, giving date of organization, membership of each union, membership fees, monthly dues, strike, sick, and funeral benefits, wages and hours of labor, regulations governing apprenticeship, number of members idle, etc.

STRIKES AND LOCKOUTS.—Brief accounts are given of 9 strikes and 2 lockouts which occurred in the State during the two years ending September 30, 1908.

INDUSTRIES.—Reports from manufacturing, agricultural, transportation, and other industries of the State, present capital and output, wages and hours of labor, number of employees, and miscellaneous data.

ACCIDENTS.—In the sawmills and factories of the State during the two years ending September 30, 1908, 109 persons were accidentally injured, the injuries of 12 resulting in death.

RHODE ISLAND.

Twenty-first Annual Report of the Commissioner of Industrial Statistics, made to the General Assembly at its January session, 1908.
George H. Webb, Commissioner. iv, 1,168 pp.

This report is made up of two parts. In the first, consisting of 1,084 pages, is contained the results of the census of 1905, presenting tables relating to the foreign-born population, church statistics, size of families, ownership of homes, age grouping, political condition, conjugal condition, maternity, color and race, and nativity of parents. In the second part, which covers 84 pages, is presented an account of the strikes and lockouts which occurred during 1907, a directory of labor organizations, and statistics of manufactures for the year 1906.

STRIKES AND LOCKOUTS.—This presentation consists of a chronological arrangement of the strikes which occurred in the State during the year ending December 31, 1907, compiled from records kept by the state labor bureau, from the columns of the public press and from other sources.

MANUFACTURES.—In this section comparative statistics for the years 1905 and 1906 are given for the textile, rubber, and fine metal manufacturing industries, showing number of establishments and character of organization; highest, lowest, and average number of employees; wages; number of employees 16 years of age and over, by sex, and children under 16 years of age; cost of materials used and value of goods made and work done; number and character of machines in operation, etc. The fine metal work embraces jewelry, jewelers' findings, silversmithing and silverware, refining, electroplating, enameling, engraving, diesinking, and lapidary work.

Comparative summary statistics for the years 1905 and 1906 are presented for 9 industries in the table following:

COMPARATIVE STATISTICS FOR 9 SELECTED MANUFACTURING INDUSTRIES, 1905 AND 1906.

Industry.	Year.	Estab- lish- ments.	Average number of employ- ees.	Total wages paid.	Cost of materials used.	Value of products, including work done.
Cotton goods.....	1905	50	20,371	\$7,255,114	\$15,724,947	\$26,083,185
	1906	50	20,245	7,854,742	16,550,421	27,112,941
Dyeing and finishing textiles....	1905	19	6,950	2,943,233	3,339,502	9,594,704
	1906	19	7,578	3,212,576	4,799,696	11,446,834
Hosiery and knit goods.....	1905	10	1,486	513,948	2,217,345	3,158,317
	1906	10	1,518	601,973	2,521,273	3,467,230
Silk goods	1905	4	811	292,851	1,007,468	1,531,916
	1906	4	795	339,164	1,578,131	2,478,618
Woolen and worsted goods	1905	50	20,882	9,106,823	41,073,816	57,360,560
	1906	50	21,002	9,643,867	41,907,860	58,543,508
Rubber and elastic goods.....	1905	4	1,468	584,380	2,498,767	3,882,809
	1906	4	1,593	645,031	2,564,640	4,022,994
Jewelry	1905	50	4,341	2,331,784	4,527,514	9,948,319
	1906	50	4,755	2,763,998	6,103,320	12,063,011
Silversmithing and silverware..	1905	6	1,998	1,514,531	2,617,030	6,142,905
	1906	6	2,156	1,601,240	2,856,157	6,433,609
Jewelers' findings	1905	10	465	268,858	1,980,903	2,632,897
	1906	10	509	312,969	2,765,510	3,530,550

A comparison of the data for the two years shows that the total establishments (133) in the 5 textile industries employed 51,138 employees in 1906 and 50,500 in 1905, paid in wages a total of \$21,-652,322 in 1906 and \$20,111,969 in 1905, used materials to the amount of \$67,357,381 in 1906 and \$63,363,078 in 1905, and manufactured products to the value of \$103,049,131 in 1906 and \$97,728,682 in 1905.

RECENT FOREIGN STATISTICAL PUBLICATIONS.

CANADA.

Wage-earners, by occupations. Bulletin I, Census and Statistics Office, 1907. xxviii, 105, xxx pp.

This volume presents data for wage-earners as shown by the census of 1901, here presented by occupations for the Dominion. Records of wages were made for each person employed in any industrial or other occupation who was paid wages or other money allowance, whether employed at home or elsewhere.

The schedule called for the occupation, the months employed at trade in factory, months employed at trade at home, months employed in any other occupation, earnings from regular employment, and extra earnings from any other than the chief occupation or trade. Nine principal classes of occupations were made, and the following table shows the number of occupations found to exist in each class for the Dominion of Canada:

NUMBER OF OCCUPATIONS OF WAGE-EARNERS. BY CLASSES.

Classes of occupations.	At regular employment.			At extra employment.		
	Total kinds of occupations.	Occupations employing males.	Occupations employing females.	Total kinds of occupations.	Occupations employing males.	Occupations employing females.
Agricultural	23	22	5	12	12	.....
Domestic and personal	42	39	21	28	24	12
Fisheries and fishing	4	4	.....	3	3	.....
Forestry and lumbering	19	19	.....	12	12	.....
Manufacturing	1,256	1,185	377	277	261	44
Mining	43	43	.....	22	22	.....
Miscellaneous	21	21	.....	8	8	.....
Professional	61	60	25	36	35	10
Trade and transportation	152	151	59	108	107	13
Total	1,621	1,494	487	506	484	79

As will be seen, the total number of occupations enumerated is 1,621 for those classed as regular employments, besides 506 given under the heading of extra employments. Of occupations in the first group, 487 employ females, and in the second 79 employ females. The greatest variety of employments is to be found in the manufacturing class and the least in that of fisheries and fishing. In four of the nine principal classes no females are employed. The competition of female labor is not so keenly felt in Canada as in many other countries. It varies considerably also in the different Provinces of the Dominion. For Canada, as a whole it is found that females are employed in 30 per cent of the occupations and males in 92 per cent.

The table below shows the percentage of occupations giving employment to each sex in the Provinces of the Dominion:

PERCENTAGE OF OCCUPATIONS EMPLOYING EACH SEX, IN THE VARIOUS PROVINCES.

Provinces.	Per cent of occupations employing—	
	Males.	Females.
British Columbia	95.00	12.70
Manitoba	96.00	21.00
New Brunswick	94.64	23.00
Nova Scotia	95.20	19.21
Ontario	93.10	30.15
Prince Edward Island	87.72	19.29
Quebec	93.74	33.14
The Territories	88.00	16.30

As to actual numbers of wage-earners in Canada, the census disclosed a total of 922,591 persons, of whom 736,549 were males and 186,042 were females. Full records were not available for all of these, so that the totals of the tables are for 661,485 males and 153,445 females. In proportion to the total population, about 40 per cent of the males and 10 per cent of the females are represented in the tables. The ratio of female to male wage-earners is least in the far western Province of British Columbia, where it is as 1 to 16.61, and is greatest in Quebec, where it is as 1 to 3.77. In Manitoba it is as 1 to 4.30, in New Brunswick as 1 to 4.85, in Nova Scotia as 1 to 6, in Ontario as 1 to 3.84, in Prince Edward Island as 1 to 3.90, in the Territories as 1 to 7.10, and for the Dominion the ratio is as 1 to 4.30.

Making the comparison by classes, the ratio of female to male wage-earners is as 1 to 790 in agriculture, 1 to 2.08 in domestic and personal service, 1 to 4.55 in manufacturing, 1 to 1.34 in the professional class, and 1 to 10.41 in trade and transportation.

The number of persons employed at their regular occupations, together with their total and average earnings, is shown by classes and sexes in the following table:

NUMBER AND EARNINGS OF EMPLOYEES AT REGULAR WORK, BY CLASSES OF OCCUPATIONS AND SEX.

Classes of occupations.	Employees.		Total earnings of—		Average earnings of—	
	Males.	Females.	Males.	Females.	Males.	Females.
Agricultural	72,696	92	\$15,088,523	\$13,453	\$207.55	\$146.23
Domestic and personal	140,978	67,752	38,411,472	9,285,169	272.46	137.05
Fisheries	7,372	.....	1,513,931	.....	205.36	.....
Forestry and lumbering	16,438	.....	5,014,821	.....	305.07	.....
Manufacturing	226,001	49,662	91,110,433	9,597,784	403.14	193.26
Mining	23,898	.....	12,278,110	.....	513.77	.....
Miscellaneous	523	.....	202,745	.....	387.65	.....
Professional	29,574	22,110	20,018,090	5,731,011	676.88	259.20
Trade and transportation	144,005	13,829	72,466,667	3,296,776	503.22	238.39
Total	661,485	153,445	256,104,792	27,924,193	387.16	181.98

From this table it appears that the largest number of males is employed in the manufacturing, trade and transportation, and domestic and personal classes; while females are found in greatest numbers in the domestic and personal, manufacturing, and professional classes. The average per capita earnings of males are largest in the professional class, followed by mining, trade and transportation, and manufacturing, in the order named, while for females the largest earnings are found in the professional class, trade and transportation coming next. In the professional class are included government and municipal employees, school-teachers, and stenographers and typewriters.

In discussing the subject of extra earnings it is stated that the whole number of persons who procured work at employment outside of their usual occupations was 20,351, of whom 19,399 were males and 952 were females. Not only is the number of females securing extra work quite small, but it is also restricted to four classes of occupations. The total amount earned by extra work by females was but \$63,472, or an average of \$66.67. For males the total earnings were \$2,442,323, or an average of \$125.90. The following table shows the total and average amount of extra earnings by classes of occupations for each sex:

NUMBER AND EARNINGS OF EMPLOYEES AT EXTRA WORK, BY CLASSES OF OCCUPATIONS AND SEX.

Classes of occupations.	Employees at extra work.		Earnings at extra work of—		Average earnings of—	
	Males.	Females.	Males.	Females.	Males.	Females.
Agricultural	1,766	.....	\$144,471	.....	\$81.81	.....
Domestic and personal	2,387	310	224,122	\$17,230	93.89	\$55.53
Fisheries.....	1,003	.....	101,706	.....	101.40	.....
Forestry and lumbering	547	.....	57,804	.....	105.67	.....
Manufacturing	7,606	289	876,273	17,858	115.20	61.79
Mining	311	.....	68,108	.....	219.00	.....
Miscellaneous	40	.....	5,216	.....	130.40	.....
Professional.....	1,757	288	355,124	21,614	202.12	75.05
Trade and transportation.....	3,982	65	609,499	6,770	153.06	104.15
Total.....	19,399	952	2,442,323	63,472	125.90	66.67

ITALY.

Inchiesta sul lavoro notturno dei fornai. Ministero di Agricoltura, Industria e Commercio. Ufficio del Lavoro. 1906. viii, 106 pp.

This volume, published by the Italian bureau of labor as a study of night work in Italian bakeries, is divided into two parts, designated as general and special. The first reviews the present condition of the bakery industry, including the conditions of labor, hygienic

and social conditions, and the results of agreements between employers and employees and of legislation applicable to employees in bakeries. In this section free use is made of studies and official reports presenting conditions in various foreign countries as well as in Italy. The unprogressive nature of the industry, compared with most others in modern times, is first noted, and the tendency to local monopoly arising from the nature of the product. Prolonged hours of labor and broken periods of repose were found to characterize the employment, conditions which were aggravated by poorly lighted and ventilated workrooms and the practice of the workmen seeking to obtain needed rest by lying on tables, bags, benches, and even on the floor of the workrooms. The last chapter of this section presents data as to trade diseases, copied from various sources.

The second section presents the results of the actual investigation conducted by the bureau itself, the four chapters taking up, respectively, the history of the movement for daytime employment in Italian bakeries; the schedule of inquiry and the results obtained in the matter of hours of labor, time of beginning and ending the day's work, the employment of shifts, power used, sanitation, equipment, etc.; the schedule of inquiry and the answers as to the possibility of reducing the amount of night work, and the schedule and replies on the results obtained by substituting day for night work.

From the account given of the movement to secure the reduction of night work, or the substitution, as far as possible, of day work, it appears that the subject was first brought prominently to notice at the general meeting of bakery employees in 1883, though little was done until after the meeting of the next year, when a vigorous campaign accompanied by strikes was begun. These efforts were unsuccessful, and other matters pressed to the front, so that this subject was dropped for some years. It was again taken up in 1901, though a few unsuccessful experiments were tried in various localities during the intervening years.

Day labor was found to be employed in a number of localities, in part by reason of agreements between employers and employees, and in part as the result of municipal regulations. These gains were encouraging, but failed of reaching the end aimed at by the federation of bakery employees, and in 1904 a petition was submitted to the bureau of labor asking that a study of the question be made with a view to the entire abolition of night work in the manufacture of bakery products, and it is as a result of this united effort that the present investigation was undertaken.

The first schedule of inquiry sought to disclose the general conditions prevalent in the bakeries, and was sent to each of the 62 leagues or unions of bakery employees then in existence in the coun-

try. Repeated efforts secured replies from but 42 unions, covering 555 establishments with 2,247 employees. As the census of 1901 reported 45,093 employees in bakeries and similar employment, the returns are clearly far short of complete, and are in some instances incorrect. However, the report is thought to be fairly representative of the conditions existing throughout the Kingdom.

Of the 555 establishments for which data were obtained, 72, with 405 employees, made use of machinery for the kneading of the dough, the number of employees in each ranging from 2 to 50, the average being 5.63 per establishment, as compared with an average of 4.05 in all establishments reported.

The following table shows the hour of beginning work in the bakeries reported on in this respect, and the number of employees affected:

NUMBER OF BAKERIES BEGINNING WORK AT SPECIFIED HOURS AND NUMBER OF EMPLOYEES AFFECTED.

Hour of beginning work.	Number of establishments.	Number of employees.	Hour of beginning work.	Number of establishments.	Number of employees.
5 p. m.	18	88	3 a. m.	3	11
5.30 p. m.	5	20	4 a. m.	3	11
6 p. m.	26	128	4.30 a. m.	1	4
6.30 p. m.	4	27	5 a. m.	9	50
7 p. m.	50	187	6 a. m.	23	91
7.30 p. m.	7	21	6.30 a. m.	1	8
8 p. m.	52	210	7 a. m.	1	4
8.30 p. m.	6	16	7.30 a. m.	3	13
9 p. m.	67	188	8 a. m.	2	7
10 p. m.	62	194	11 a. m.	3	13
10.30 p. m.	4	12	12 noon.	1	3
11 p. m.	40	138	1 p. m.	19	53
11.30 p. m.	1	3	2 p. m.	8	36
12 midnight.	43	138	3 p. m.	10	37
1 a. m.	7	22	4 p. m.	10	44
1.30 a. m.	2	5	4.30 p. m.	2	9
2 a. m.	18	42			

An examination of the above table shows that night work is the rule and employment by day the exception, since, of the 511 establishments reported, 415, having 79 per cent of the employees, begin work from 5 p. m. to 3 a. m., inclusive, while the number beginning work so as to exclude night work mainly or entirely, i. e., from 5 a. m. to 12 m., is but 43, with but 189 employees, or 10 per cent of the total number under consideration.

To discover the length of the working day, three forms of inquiry were adopted—one as to the hours of beginning and ending work, one as to the daily period of rest, and the third as to the hours of effective labor. In the great majority of cases the answers to the second and third inquiries were not satisfactorily given. From the answers to the first, the following table is obtained:

NUMBER OF BAKERIES REQUIRING SPECIFIED HOURS OF WORK, AND NUMBER OF EMPLOYEES AFFECTED.

Hours of work.	Number of establishments.	Number of employees.	Hours of work.	Number of establishments.	Number of employees.
5.....	1	2	14.....	68	275
6.....	3	4	14½.....	3	15
7.....	9	22	15.....	26	96
8.....	17	56	15½.....	2	8
8½.....	1	1	16.....	26	118
9.....	37	83	16½.....	5	22
9½.....	3	7	17.....	12	53
10.....	63	199	17½.....	2	13
10½.....	2	6	18.....	8	32
11.....	61	213	19.....	16	32
11½.....	7	23	19½.....	1	4
12.....	131	480	20.....	3	9
12½.....	9	33	21.....	17	48
13.....	51	154	22.....	1	4
13½.....	5	16			

Employment in bakeries is pointed out as differing from other employments, which generally have a definite time for beginning work, continuing without interruption to a definite quitting time, with established intervals of rest. Bakery employees have frequent short intervals of rest between the various operations, but not generally of any important length or of fixed recurrence; and even in those rare instances where periods of two or three hours of rest are allowed, the workman must remain subject to call, and would much prefer continuous employment and a complete release thereafter. In many shops the practice was observed of locking the employees in during the entire period of the working day. The figures given above, therefore, while they somewhat exceed the actual hours of effective employment, show the period during which the employee is subject to orders. No explanation is given of the fact that the total number of establishments shown is 590, or 35 in excess of the number stated to have been reported on in the first schedule.

Seventy-one establishments observe a shorter day than ten hours; 426 work from ten to fifteen hours, inclusive, and 93 work in excess of fifteen hours. Fifty-five per cent of the number of employees shown in the above table work from ten to thirteen hours; 16.5 per cent are detained for sixteen hours or more, while but 8.6 per cent work less than ten hours. The evil effects of the long hours of employment and of confinement within the work places were found to be aggravated by the hygienic conditions, of which it was said that they could not possibly be worse.

The inquiry as to the practicability of substituting day for night work elicited radically different replies. Of the 288 employers or managers expressing an opinion, 110 were unconditionally favorable, 28 were partially favorable, 72 were classed as partially opposed, and 78 as absolutely opposed. Of the establishments from which these

expressions were obtained, 258 were under the ordinary proprietary form, 26 were cooperative, and 4 were managed by the municipality. Of the first class, 91 were favorable to day labor and 78 opposed, the remaining 89 being classed as of qualified or intermediate opinion. Of the cooperative class, 17 were favorable, none opposed, and 9 gave qualified opinions; while of the last group, 2 were favorable, none opposed, and 2 of a qualified opinion.

The objections offered began with the legal one that a law regulating hours of labor would interfere with the freedom of contract and the liberty of individuals; to which the employees replied that the court of cassation had upheld the constitutionality of such a regulative law, and that it was not a question of the acts of the employer as an individual, but of his conduct toward others. Other objections were based on the public needs, the organization of the industry, and the expense attendant on producing the necessary output in the restricted period proposed. The replies were that the question was one merely of custom, and data were offered to show the incorrectness of the statement as to the necessity of increasing the number of plants and of employees.

The third schedule sought to disclose the results of the change made in a number of establishments where day work was already in use at the time of the investigation. There were 106 of these from which reports were secured, 4 being classed as large, 21 as medium, and 81 as small establishments; 98 were under ordinary proprietorship, 7 were cooperative, and 1 was a communal plant. The replies were entirely favorable in 34 instances, 2 being from large establishments, 3 from those of medium size, and 29 from small plants; 24 partially favorable replies were made, 1 by a large establishment, 4 from those of medium size, and 19 from small ones; while unfavorable reports were made by 44 establishments, of which 1 was large, 14 medium, and 29 small. As to proprietorship, of those reporting favorably 28 were under the usual form, 5 were cooperative, and 1 communal; while of those partially favorable 22 were ordinary and 2 cooperative. All the 44 unfavorable replies were from bakeries under the ordinary forms of proprietorship.

Effects involving loss or inconvenience were reported by 102 establishments, 8 stating that they were required to make changes in their ovens, increase the number, etc.; 5 had to alter and enlarge their work-rooms; 10 required more workmen; 1 introduced a kneading machine; 5 lost part of their trade; 3 reduced production; 1 lost retailers; 1 ceased to send bread to the homes of its customers; and 2 lost incidental work, as of cooking for patrons, etc.

The public made considerable complaint when the changes were introduced, but much of this ceased when experience and adjustment had operated to remove some of the grounds for objection. It can

not be said as yet, however, that the change is one that is generally approved by the consumer, but the most serious objections have been met, and fresh bread of the accustomed quality is found to be as easily obtainable as under the old régime, and in only one instance was an increase in cost reported.

The industrial condition of the employees is felt to be generally improved, the hours of labor being reduced by the elimination of periods of inactivity that were found to be incident to night work, and because they are excused from the work of distribution. Their moral and social condition also is said to have improved by reason of the change. No changes in earnings are reported. The master bakers were for the most part dissatisfied with the change, but none is reported to have given up his business, and they, like the consuming public, have found that many of the difficulties first met with are capable of being overcome; and at a meeting in 1906 of proprietors of bakeries representing the whole of Italy, a majority were found to be in favor of an inquiry into the whole subject of the change of working time, on the grounds of the humanitarian objects to be gained thereby.

Abolizione del lavoro notturno nell' industria della panificazione. Legge 22 Marzo, 1908, n. 105, e relazioni parlamentari al disegno di legge presentato dal Ministro di Agricoltura, Industria e Commercio. Supplemento al Bolletino dell' Ufficio del Lavoro. 1908. 86 pp.

This pamphlet, issued by the ministry of agriculture, industry, and commerce, presents the law of March 22, 1908, passed by the Italian Parliament for the abolition of night work in bakeries and pastry shops.

As a result of the agitation described in the inquiry into the subject of night work in bakeries as presented in a foregoing digest (*Inchiesta sul lavoro notturno del fornai*), the law was drafted by the ministry and was adopted practically in the form in which it was presented to the Parliament. The body of the present report is made up of hearings held by Parliament through its permanent committee on labor for the purpose of ascertaining more fully the attitude of those interested, and their reasons for and against the proposed law. Not only the subject of hours of daily labor, but also those of holidays and hygienic conditions were discussed at these hearings.

The law itself restricts labor in the production of bread and pastry to the hours between 4 a. m. and 9 p. m., except that on Saturday labor may be protracted to 11 p. m. This limitation applies to all operations of the preparation of leaven, the heating of the ovens, kneading, and the making and baking of bread and pastry. Under

exceptional conditions of the industry and locality and in the manufacture of particular qualities of bread a communal council may grant modifications as to the time for beginning work not in excess of two hours during the months of June, July, August, and September. Appeals may be taken from the decision of the communal council to the minister of agriculture, industry, and commerce, pending which any order of the council shall be suspended.

Transitory conditions of labor or the occurrence of festivals may be considered by the communal council as reasons for brief suspensions of the operation of the law for a period not exceeding one week. Enforcement of the law is committed to the inspectors of industry and labor and to the communal officers of hygiene, with the cooperation of the local police.

NEW SOUTH WALES.

First Annual Report of the Director of Labor, State Labor Bureau of New South Wales, for the year ending June 30, 1906. State Labor Bureau, 1906, 61 pp.

This report is the first annual report of the director of labor for New South Wales, the office having been created to succeed that of labor commissioner. The work of the labor bureau was practically that of undertaking to meet the needs of the unemployed classes of New South Wales. The report, therefore, is made up principally of an account of the various means used by the government through this agency for the administration of relief and the furnishing of employment. The various lines of activity included a free registry office at the capital, with 43 branch offices at principal points throughout the country. These registers were open to men wanting work, whatever their capacities, and to employers who would indicate in their registration the class of labor they desired. No fees were charged either party. The bureau issued railway and steamer fares on credit, repayments to be made by the person benefited after a lapse of a month or more, according to circumstances. These payments were usually guaranteed by the employer or some other responsible person, though this was not a uniform requirement. Members of the family, furniture, farm animals, etc., were also sometimes forwarded by means of advances made by the bureau.

The catching of rabbits, both for their skins and for their meat, is an important industry of New South Wales, and considerable numbers of men find employment in this way, and the bureau has found it a profitable line of assistance to furnish traps, tents, blankets, and other necessary equipment for men going out as "rabbiterers." In past years miners' equipments had been furnished as a means of assistance, though this has been less common of late.

Various farms, located at different points, have been maintained for the employment of destitute men, where they could hire out as laborers for a moderate return, and where anyone may receive at least food and lodging in return for a limited amount of service. These farms are also found useful in giving a measure of practical training to men, who are thereby qualified to take places as farm laborers. This latter feature is made a special part of the work at one of the farms, where boys are trained for some weeks, after which they are sent to a more general place of employment and further trained until ready to go on farms as general laborers. The demand for boys so trained is in excess of the supply. The bureau is also an information office concerning labor conditions in all centers of population in the State.

One of the results which the bureau claims to have attained by its activities is the practical elimination of the occupation of "leaders of the unemployed," since unemployment is, in effect, rendered unnecessary by the variety of opportunities offered through the various activities of the bureau. This result was favored by an improvement in the industrial condition of the country, which is mainly agricultural, though the year covered by the report was a profitable one for mining as well. The report of the general register of applicants for work shows 1,241 new registrations during the year, with 361 remaining over from the previous year. Of these, 814 were single men or widowers without dependents, while 788 were married men or widowers with dependent children. A special trades-union register was maintained at one point, but was very little used, only 16 registrations having been made. Registration has been maintained by the government under practically the present system since 1900, and the following table shows the number of reregistrations, new registrations, and total for the year, for a period of six years.

REGISTRATION OF APPLICANTS FOR EMPLOYMENT AT THE STATE LABOR BUREAU, NEW SOUTH WALES, 1900 TO 1906.

Year.	Reregistrations.	New registrations.	Net registrations for the year.
1900-1901.....	6,343	3,099	9,442
1901-2.....	1,391	2,243	3,634
1902-3.....	740	2,114	2,854
1903-4.....	2,513	1,482	3,995
1904-5.....	885	998	1,883
1905-6.....	361	1,257	1,618
Total	12,233	11,193	23,426

An examination of this table shows that there has been in general a decrease in the number of men who designated themselves as unemployed and called on the government to find them work. A report of

the classes of work to which men were sent during the year for which this report was made shows that 494 went to government work, 1,228 to private work, 1,870 to labor depots, and 377 to the casual labor farm, or a total of 3,969 persons sent to work.

Men desirous of being kept on the register as eligibles for work are required to report themselves once each month. It is found that large numbers of men register a single time and are never seen or heard of again; thus in 1902-3 of 16,000 men on the books nearly three-fourths of the whole number had dropped out of sight for a term of more than twelve months, so that the registration figures are not reliable as showing the number of persons actually desiring employment. A reregistration was attempted to secure the elimination of useless names, more than 7,000 persons coming in under this new registration. It is estimated that probably two-thirds of these were not really to be fairly considered as "live" registrations. A fairer test of the number of persons desiring employment at any given time is the number actually enrolling during the month; thus on the 31st of July, 1905, 929 persons were believed to be actually eligible for work. This number fell to 257 registering during November, while the winter months increased the enrollment, which was for December 771, for January 735, and for February 719, after which the enrollment fell off to the end of the fiscal year.

The report is taken up in considerable measure with the discussion of the details of the methods used by the bureau itself and the experience of investigators and of the official agencies of various countries. Detailed reports are furnished by each of the local agents as to the opportunities in their various localities, including rates of wages and the classes of employment which are available. There are also presented in appendixes details as to the locations and kinds of work to which men were sent and the trades and occupations represented by those registered for employment.

ROUMANIA.

Progresele Economice ale României indeplinite sub Domnia M. S. Regelui Carol I, 1866-1906. Tablouri Figurative și Notițe explicative de Dr. L. Colescu. Șeful Serviciului Statisticei Generale. 1907. 109 pp.

The object of this publication by the chief of the general statistical office of Roumania is to present a review of the moral, intellectual, and material development of the Kingdom during the reign of Charles I. Text, statistical tables, and graphic representations are used to show the economic and other changes that occurred during the four decades of the period covered, the principal subjects pre-

sented being agriculture, manufactures, fisheries, commerce, and the production of petroleum. Banking, the postal service (including telegraphs and telephones), and the national finances are also discussed.

With an area of 130,177 square kilometers (50,261 square miles) the population at the census of 1899 was 5,956,690, and was estimated at 6,600,000 in 1906, a growth of approximately 60 per cent since 1866.

The country enjoys a vigorous birth rate, sometimes exceeding 40 per 1,000, the average for the five years preceding the publication of the report being 39.4 per 1,000. The death rate is also high, ranging from 24 to 27 per 1,000, the average for five years being 25.4. The urban population is given at 19 per cent of the total, leaving 81 per cent to be classed as rural. The population of the largest city, Bucharest, is approximately 300,000, the next in size being about one-fourth as large. The country's growth is favored by a fact in respect of which it differs from most of its neighbors in that its immigration exceeds its emigration, though no accurate statistics on the subject have been collected.

The country is preeminently agricultural, this interest, as well as commerce, having largely increased during the period under consideration.

An investigation conducted in 1901-2 disclosed the existence of 62,188 industrial establishments, of which 625 were classed as belonging to the large industries, 54,405 to the average and small industries, and 6,923 to special small industries, besides 235 establishments representing the so-called extractive industries. The number of employees was given as 170,000, of whom 40,000 were engaged in the large industries.

The largest single group of establishments (30 per cent of the total) was engaged in the manufacture, etc., of clothing; woodworking, furniture, the metal-working industries, and the preparation of food products followed in the order named. Of the large establishments, the largest group is that of mills for the grinding of grain. Of the 247,000,000 francs (\$47,671,000) of capital invested in the large industries, 111,000,000 francs (\$21,423,000) were invested in factories for the preparation of food products (including breweries and distilleries), 31,000,000 francs (\$5,983,000) in the chemical industries, and 29,000,000 francs (\$5,597,000) in the metal-working industries. In 502 important establishments 961 motors were in use, developing 45,211 horsepower.

The value of raw material required in the large industries averages 121,000,000 francs (\$23,353,000) per annum, and the average annual production amounts to 231,000,000 francs (\$44,583,000). Of this last

amount, 131,000,000 francs (\$25,283,000), or 56 per cent, belongs to the class, food products; 23,000,000 francs (\$4,439,000), or 9 per cent, to the chemical industries and 17,000,000 francs (\$3,281,000), or 7 per cent, to the metal-working industries.

The 19,000 establishments engaged in the manufacture of clothing employ in excess of 40,000 persons; 12,000 small woodworking shops have 15,000 employees, and 10,000 in which metal working is carried on employ approximately the same number.

An important industry is that of the production of petroleum. This has made a rapid growth of late years, the ratio of progress for each decade, starting from 100 as a basis in 1866, being 255 in 1876, 396 in 1886, 1,278 in 1896, and 8,400 in 1905. The actual production in 1866 is given as 5,370 metric tons of 2,204 pounds, and in 1905-6 as 682,000 metric tons. Twenty-two large refineries are reported, representing an invested capital of 24,500,000 francs (\$4,728,500) and employing 1,045 workmen.

DECISIONS OF COURTS AFFECTING LABOR.

[Except in cases of special interest, the decisions here presented are restricted to those rendered by the federal courts and the higher courts of the States and Territories. Only material portions of such decisions are reproduced, introductory and explanatory matter being given in the words of the editor.]

DECISIONS UNDER STATUTE LAW.

EMPLOYERS' LIABILITY—EMPLOYMENT OF CHILDREN—VIOLATION OF STATUTE—CONTRIBUTORY NEGLIGENCE—COURSE OF EMPLOYMENT—*Smith's Administrator v. National Coal and Iron Company, Court of Appeals of Kentucky, 117 Southwestern Reporter, page 280.*—This case was before the court of appeals of Kentucky on an appeal from the circuit court of Bell County. The plaintiff sued as administrator of a boy, Bentley Smith, who lost his life while in the employment of the company above named. The boy being under 14 years of age, his employment was in violation of the state law prohibiting the employment of any child less than 14 years of age in any workshop, factory, or mine in the State. A short time before his death the boy went with his father, who was a miner in the regular employment of the company, for the purpose of working in the mine. The foreman asked the boy's age, and on being told that he was not 14, refused to permit the boy to work in the mine. The father was injured soon afterwards so that he was unable to work, whereupon the boy proposed that he should take his father's place, which the father forbade; but the boy went and was put to work by the foreman, who showed him how to shovel and told him how to run under the coal. The boy went to work and was credited with his earnings, which were applied to the rent of the house which his father occupied. After less than three weeks of his employment young Bentley was leaving the mine at noon, riding, as was the usual custom, on the loaded cars of coal. While attempting to pass from one car to another he fell between the two and was run over and killed.

The court below instructed the jury to find for the defendant company, apparently on the idea that the death of the child was due to his own act in walking over the cars. It was further insisted that this was a proper instruction on the ground that he was not then engaged in work for his employer and that his injury was due to his own want of care.

The decision of the court below was reversed on grounds which appear in the opinion of the court of appeals, as delivered by Judge Hobson, which is, in part, as follows:

The boy was serving the master in the mine. He had been getting out coal all the morning. It was necessary that he should leave the mine at noon when the shots were fired. In leaving the mine he was in the regular course of his duty, and it was customary for all the miners to ride out on the cars or to ride in on them. The statute which forbids the employment of children in mines is for their protection. It was a violation of the statute for the child to be employed in the mine. The evidence was plainly sufficient to show that he was employed; and, as he was injured in the mine while going from his place of work to the shaft, it can not be said that he was not injured in the course of his employment in the mine. The statute made it unlawful for him to be employed in the mine, and whether he was injured while at his work in the mine, or in going to his work or coming from his work, is immaterial. It has been held by this court in several cases that, where a statute prohibits a thing for the benefit of a person, he may maintain an action to recover damages sustained by reason of the violation of the statute. [Cases cited.]

We see no reason why this principle should not be applied to infants who are injured when employed in violation of the statute, for manifestly the purpose of the statute is to protect infants from the dangers attending the forbidden employments, which by reason of their youth they would not fully appreciate. While there is some conflict in the authorities, the weight of authority seems in favor of the rule that the breach of the statute is actionable negligence whenever it is shown that the injuries were sustained in consequence of the employment. (*Queen v. Dayton Coal Co.*, 95 Tenn. 458, 32 S. W. 460; *Rolin v. Reynolds Tobacco Co.*, 141 N. C. 300, 53 S. E. 891; *American Car Co. v. Armentraut*, 214 Ill. 509, 73 N. E. 766, [etc.].)

This is an action to recover for the death of the intestate. No cause of action existed at common law to recover for death, and an action to recover for the death of a person can only be maintained in this State by virtue of section 6, Ky. St., enacted pursuant to section 241 of the constitution. It is well settled that contributory negligence may be pleaded as a defense to an action brought under this section. (*Passamaneck v. Louisville, etc., R. R. Co.*, 98 Ky. 195, 32 S. W. 620; *Clark v. L. & N. R. R. Co.*, 101 Ky. 34, 39 S. W. 840.) As the action can only be maintained under the statute referred to, and as contributory negligence may be pleaded as a defense to an action under the statute, it necessarily follows that contributory negligence may be relied on by the defendant in bar of the plaintiff's action. A child under 14 years of age is only required to exercise such care as may be reasonably expected of a child of his age under like circumstances. The law takes into consideration that children lack the discretion of grown persons, and that a child under 14 years of age may reasonably be expected to do things which an older person would not do. Whether the intestate used ordinary care in passing over the cars as he did is a question for the jury. (*Ornamental Iron, etc., Co. v. Green*, 108 Tenn. 161, 65 S. W. 39.) Of course, as we have not the proof of the defendant before us, we now only pass

upon the case as presented by the proof for the plaintiff. On the proof for the plaintiff the court should have refused to give a peremptory instruction to the jury to find for the defendant.

Judgment reversed, and cause remanded for a new trial, and further proceedings consistent herewith.

EMPLOYERS' LIABILITY—"RAILROAD HAZARDS"—CONSTRUCTION OF STATUTES—*American Car and Foundry Co. v. Inzer, Supreme Court of Indiana, 87 Northeastern Reporter, page 722.*—Mary Inzer had recovered damages for the death of John A. Inzer, caused, as was alleged, by the negligence of the above-named company, in whose employment he was. The company builds cars, and Inzer was a tinner employed in roofing a car when the car on which he was working was moved by a locomotive of the railway passing through the company's plant, by which movement Inzer was killed. The circuit court of Clark County awarded damages to the plaintiff on the ground that the employment was connected with the hazardous business of railroading, which view was affirmed by the appellate court, 86 N. E. 444. (See Bulletin 81, p. 415.) The case was appealed to the supreme court of the State, which reversed the decision of the court below, on the ground that the section of the law relied on (Burns' Ann. Stat. 1901, sec. 7083, ed. of 1908, sec. 8017) does not cover employment of this nature.

The opinion of the supreme court was delivered by Judge Monks, and is, in part, as follows:

It appears from each paragraph of the amended complaint that appellant was a corporation engaged in the manufacture of cars at its plant in Clark County, and then and there maintained a building, where cars were constructed, and "that in said building there was a railroad track which was laid lengthwise in said building, and which extended through the same and outside and through the yard of said defendant upon which said plant was then and there located and connected with the track of the Baltimore & Southwestern Railroad Company." Said Inzer was in the employ of appellant as a tinner, and by his contract required to work on the roof of the cars being constructed by appellant.

In *Bedford Quarries Co. v. Bough*, 168 Ind. 671, 80 N. E. 529, this court on March 1, 1907, held the employers' liability act of 1893, being sections 8017-8020, Burns' Ann. St. 1908 (sections 7083-7087, Burns' Ann. St. 1901), while constitutional as to railroads, was unconstitutional as to private corporations. This was upon the ground that the act imposed burdens upon private corporations not placed upon individuals or partnerships engaged in a similar business under like circumstances and conditions; that said classification had no reasonable basis, because made to depend upon the character of the employer, and not upon the character of the employment. In *Pittsburgh, etc., R. Co. v. Lightheiser*, 168 Ind. 438, 78 N. E. 1033, this court, following the

cases therein cited, held that said act put railroads in a class by themselves, that said classification was proper on account of the dangerous and hazardous character of the business of operating railroads, that such classification was not based upon the difference in employers, but upon the difference in the nature of the employment, and that the same was constitutional as to railroads. It was also held in said case, which was decided October 31, 1906, that said act regulates the liability of railroads regardless of whether they are operated by persons, companies, or corporations; in other words, it includes any person, company, or corporation engaged in operating a railroad in this State. (See, also, *Indianapolis, etc., Co. v. Kinney*, 85 N. E. 954, and cases cited.)

There are no facts alleged in either paragraph of the amended complaint showing that appellant was engaged in the operation of a railroad at the time the deceased received the injuries which caused his death. The fact that there were tracks in appellant's yard and buildings on which the cars were constructed and moved by a locomotive engine from place to place thereon for convenience or other purpose in the construction and storage of said cars, and that the same connected with the tracks of a railroad company, did not make the same a railroad or railway; nor was such use thereof by appellant the operation of a railroad within the meaning of said liability act. In the cases cited by appellee to sustain her contention as to the sufficiency of the amended complaint, the defendants were engaged in the operating of railroads for the transportation of freight in the conduct of their private business. Whether such cases are applicable to the law in controversy here we need not decide, for the reason that no such state of facts is shown by the amended complaint. It is proper to say that this case was tried and final judgment rendered by the court below before *Bedford Quarries Co. v. Bough*, supra, and *Pittsburg, etc., R. Co. v. Lightheiser*, supra, were decided by this court.

Judgment reversed, with instructions to sustain the demurrer to the amended complaint.

EXAMINATION AND LICENSING OF BARBERS—CONSTITUTIONALITY OF STATUTE—DELEGATION OF POWERS—EQUAL PROTECTION OF LAWS—*State v. Armeno*, *Supreme Court of Rhode Island*, 72 *Atlantic Reporter*, page 216.—This case involved the constitutionality of chapter 1100 of the Public Laws of 1903, which requires a practicing barber to secure a certificate of registration, and also authorizes any member of the board of examiners to enter any barber shop of the State for purposes of inspection. Grievances may be appealed to the supreme court, but no provision is made for trial by jury. The law declares insanitary barber shops to be nuisances, and provides also for a fine of not more than \$20. The law applies, as enacted, to cities, but contains a provision that the town council of any town may adopt the provisions of the act and make it applicable to the barber shops of such towns. The defendant, Armeno, raised the question of the

constitutionality of this law, and five points were submitted to the supreme court for its determination.

First. Whether or not a search authorized by the law was in violation of the state constitution, which declares the people of the State to be secure in their persons, papers, and possessions against unreasonable searches and seizures.

Secondly. Whether or not the omission of any provision for a trial by jury was constitutional.

Third. Whether or not the two forms of punishment suggested are a violation of the fifth amendment of the Constitution of the United States, which declares that no one shall be twice put in jeopardy for the same offense.

The fourth and fifth inquiries relate to the question of the application of the law, since it is applicable to towns only after adoption by the town council.

The opinion of the court was delivered by Judge Blodgett and sustained the constitutionality of the law on each of these points, on grounds that appear in the following extracts from said opinion:

Article 1, sec. 6, of the constitution of Rhode Island provides: "Sec. 6. The right of the people to be secure in their persons, papers and possessions, against unreasonable searches and seizures, shall not be violated; and no warrant shall issue, but on complaint in writing, upon probable cause, supported by oath or affirmation, and describing as nearly as may be, the place to be searched, and the person or things to be seized."

1. The portion of section 4, c. 1100, p. 28, of the Public Laws, which is claimed to be in contravention of this constitutional provision, is as follows: "Any member of said board shall have power to enter and make reasonable examination of any barber shop in any city in this State during business hours, for the purpose of ascertaining the sanitary condition thereof." As is well stated in the brief for the State, this section of the act in question does not authorize either a search or a seizure. It merely authorizes an examination, which is essentially different from a search. Nothing is authorized to be seized. No authority is given to break open doors, drawers, desks, chests, or anything else. The purpose is merely to empower the board to survey premises at reasonable times so as to know the sanitary conditions of tools, appliances, and furnishings, and to enable it to determine whether or not the law is being properly regarded. Although the conditions upon such an examination should be found to be most unclean and unsanitary, yet the examiner is not authorized to take any summary action, such as seizure of the objectionable tools, appliances, or furnishings, as the case may be; but the examination is made only "for the purpose of ascertaining the sanitary condition thereof" and to enable the board to judge whether or not the law is being obeyed, with the ultimate purpose of revoking the offender's certificate of registration after notice in writing and an opportunity to be heard with appeal to the supreme court, as provided in section 13 of the act as amended by section 1215, Court & Practice Act, 1905.

We therefore answer the first question in the negative.

2. The appeal to the supreme court provided for in section 13 is amended by section 1215, Court & Practice Act 1905, does not deprive the defendant of any constitutional right to a jury trial. The portion of section 13 in question is as follows: "Any person aggrieved by any decision or ruling of said board may, within thirty days, exclusive of Sundays and legal holidays, after receiving notice of said decision, take an appeal therefrom to the supreme court, and said court shall, as soon as may be, hear and determine said appeal." The material part of article 1, sec. 10, of the constitution of Rhode Island, is as follows: "In all criminal prosecutions, the accused shall enjoy the right to a speedy and public trial by an impartial jury." Article 1, sec. 15, of the constitution of Rhode Island, is as follows: "The right of trial by jury shall remain inviolate." Section 10, art. 1, of the constitution, has no application because such a decision or ruling of the board is not a criminal prosecution, but is simply a method provided for revoking certificates of registration when the holder thereof has shown himself unfitted to practice the occupation of barber, or has disqualified himself by his failure to post his certificate in a conspicuous place or to renew his certificate and pay the fee required by law. There is no penalty or punishment provided except the forfeiture of his license. A judicial trial, however, is secured to the defendant under this provision, and section 15, art. 1, of the constitution, does not apply to cases of this kind. (See *State v. Roy*, 22 R. I. 538, 48 Atl. 802.)

3. It is a sufficient answer to the third question submitted to say that article 5 of amendments to the Constitution of the United States does not apply to state governments, but only to the Federal Government.

As to the fourth and fifth questions, the court said:

The precise question raised seems to be: Is this law, from the fact that its prohibitions extend only to barbers in cities, a local and special law, and therefore unconstitutional? In *Missouri v. Lewis*, 101 U. S. 22, 25 L. Ed. 989, it was said by Mr. Justice Bradley (page 30 of 101 U. S. [25 L. Ed. 989]): "Each State has the right to make political subdivisions of its territory for municipal purposes, and to regulate their local government. As respects the administration of justice, it may establish one system of courts for cities and another for rural districts, one system for one portion of its territory and another system for another portion. Convenience, if not necessity, often requires this to be done, and it would seriously interfere with the power of a State to regulate its internal affairs to deny to it this right. * * * We might go still further, and say, with undoubted truth, that there is nothing in the Constitution to prevent any State from adopting any system of laws or judicature it sees fit for all or any part of its territory. * * * If every person residing or being in either portion of the State should be accorded the equal protection of the laws prevailing there, he could not justly complain of a violation of the clause referred to, for, as before said, it has respect to persons and classes of persons. It means that no person or class of persons shall be denied the same protection of the laws which is enjoyed by other persons or other classes in the same place and under like circumstances."

Nor is it a valid objection that it is a delegation of legislative power to provide that the law shall apply to a given town only upon a vote of its town council, or that the application of the law in a town shall be left to a vote of the town council and not to the vote of the electors. Thus, in *State v. Pond*, 93 Mo. 606, 6 S. W. 469, in discussing a provision of the local option liquor law of that State which became effective in all incorporated cities or towns having a population of 2,500 or more inhabitants when adopted by a majority vote of the legal voters, the court said (page 622 of 93 Mo., page 472, of 6 S. W.): "While this local option act provides that any county, town, or city of the class named, may, by a majority vote, put such county, town, or city under the operation of the law, it does not refer to them the question of passing a law. That the legislature had already done, and only called upon them to decide by a vote whether they would accept the provisions of a law regularly enacted by both houses of the general assembly and approved by the governor. By its provisions the law, and not the vote, extended its influence over the locality voting against the sale of intoxicants. It was the law that authorized the vote to be taken, and when taken the law, and not the vote, declared the result that should follow the vote. The vote was the means provided to ascertain the will of the people, not as to the passage of the law, but whether intoxicating liquors should be sold in their midst. If the majority voted against the sale, the law, and not the vote, declared it should not be sold. The vote sprang from the law, and not the law from the vote. By their vote the electors declared no consequences, prescribed no penalties, and exercised no legislative function. The law declared the consequences, and, whatever they may be, they are exclusively the result of the legislative will." (Cooley, Const. Lim. (7th Ed.) 173, 174, and cases cited.) Nor need the question be submitted to the electors. It is competent for the legislature to leave the matter to be otherwise determined.

Thus in *Commonwealth v. Bennett*, 108 Mass. 29, the court says: "It is equally within the power of the legislature to authorize a town by vote of the inhabitants, or a city by vote of the city council, to determine whether the sale of particular kinds of liquors within its limits shall be permitted or prohibited."

And it needs no argument to show that the legislature may constitutionally provide for the exercise of the police power in respect to the subject now under consideration in the same manner in which that same police power may lawfully be exercised in respect of the traffic in intoxicating liquors.

We therefore answer the fourth and fifth questions in the negative.

EXAMINATION AND LICENSING OF BARBERS—CONSTITUTIONALITY OF STATUTE—MECHANICAL PURSUITS—*Jackson v. State, Court of Criminal Appeals of Texas*, 117 *Southwestern Reporter*, page 818.—In this case, W. A. Jackson was convicted of pursuing his trade as a barber without having procured the license required by chapter 141 of the Acts of 1907. Jackson appealed from the decision of the Dallas

County court, and secured a reversal of its judgment, the point in controversy being the constitutionality of the law under which he was convicted. Judge Davidson, who delivered the opinion of the court, took up the two points as to the status of the employment of a barber and the validity of a law of unequal application to different persons in the same employment, in the order named, speaking in part as follows:

The authorities are somewhat divided as to whether or not the profession or trade of a barber is a mechanical pursuit. In Texas it has been held in *Fore et al v. Cooper* (Tex. Civ. App.) 34 S. W. 341, that the tools, implements, and appurtenances of a barber shop are exempt from execution. This ruling seems to have been followed in Tennessee in the case of *Terry v. McDaniel*, 103 Tenn. 415, 53 S. W. 732, 46 L. R. A. 559. (For some of the decisions of the different courts of the Union, see *Terry v. McDaniel*, supra.) In Louisiana the supreme court held, in *State v. Hirn*, 46 La. Ann. 1443, 16 South. 403, that the pursuit was mechanical, and that the barber was not subject to pay an occupation tax.

If we are right in the contention that appellant's business was a mechanical pursuit, the legislature was powerless to levy a tax upon it, although they might call it a license fee. This license fee does not apply to all barbers alike, even in the same classification, if classification is authorized.

The second proposition relied upon by appellant is that the act is unconstitutional, in that it is discriminating, and not equal and uniform, in that said law exempts from said license fee (1) students of the State University, and other schools of the State, who are or may be making their way through school by serving as barbers; (2) it exempts those who may be serving as barbers in any of the eleemosynary institutions of the State; and (3) it exempts persons following the occupation of barber in towns of 1,000 inhabitants or less; and it is further claimed, in this connection, that the law is void because in the particulars above mentioned it violates section 3 of the Bill of Rights of Texas, in that it grants special privileges to certain individuals and denies such privileges to this defendant; all of whom follow the same occupation. We believe these propositions are well taken, and have been so recently discussed by this court in the cases of *Ex parte Woods*, 108 S. W. 1171, and *Owens v. State*, 112 S. W. 1075, decided at the Dallas term, 1908, we deem it unnecessary to go into an elucidation of them.

The intention of this act, it would seem, from its caption, is to regulate the practice of barbering, registering and licensing persons to carry on such practice, and to insure better education of the practice, and to insure better sanitary conditions in barber shops, and to prevent the spread of disease in the State of Texas, and declaring an emergency. If the constitution, requiring all taxes to be equal and uniform, provided such a tax or license fee may be levied as provided by this bill, and it would make no difference whether it is a license fee or a tax, so far as these provisions are concerned, then barbers at the University and other schools, in eleemosynary institutions, and in towns of 1,000 inhabitants or less, are not brought within its pro-

visions, and are not subjected to the same penalties, regulations, or control as are those who come within its provisions. But, whatever may have been the thought in the legislative mind as to why these classes or persons should be exempted, in violation of the provisions of the constitution, we are of opinion that such intent can not operate, and we are of opinion that the favored and exempted classes mentioned, especially with reference to the barbers in schools and eleemosynary institutions, can not be exempt, and this law remain constitutional. Sanitary regulations should operate upon all alike, when subject to same conditions.

The law, therefore, is held unconstitutional; and the judgment is reversed, and the prosecution is ordered dismissed.

RAILROADS—SAFETY APPLIANCE ACTS—SUFFICIENT COMPLIANCE—VIOLATIONS—*United States v. Boston and Maine Railroad Company, United States District Court, District of Massachusetts, 168 Federal Reporter, page 148.*—The railroad company named was charged with violating the federal safety appliance act, the provisions and application of which with reference to certain details were discussed in the charge of Judge Dodge to the jury in the trial of the case. The following syllabus, prepared by the court, presents the rules of law governing the operation of railroads in the respects indicated:

1. Section 4 of the safety appliance act (Act March 2, 1893, c. 196, 27 Stat. 531 [U. S. Comp. St. 1901, p. 3174]) requires secure grabirons or handholds at those points in the end of each car where they are reasonably necessary in order to afford to men coupling or uncoupling cars greater security than would be afforded them in the absence of any grabiron or handhold at that point or of any appliance affording equal security with a grabiron or handhold.

2. If at any place in the end of a car there is not a grabiron or handhold, properly speaking, but some other appliance, such as a ladder or brake lever, which afforded equal security with a grabiron or a handhold at that point, the federal safety appliance law (Act March 1893, c. 196, 27 Stat. 531 [U. S. Comp. St. 1901, p. 3174]), so far as grabiron or handhold at that point is concerned, has not been violated. Having something there which performs all the functions of a grabiron or handhold is just the same thing as having what is properly called a grabiron or handhold at that point.

3. Unless the government satisfies a jury by a preponderance of the evidence that there was no grabiron or handhold on the car where there should have been one, the jury should find for the railroad company.

4. A man in connecting or disconnecting the air hose between the cars is engaged in coupling or uncoupling cars within the meaning of the safety appliance act (Act March 2, 1893 c. 196, 27 Stat. 531 [U. S. Comp. St. 1901, p. 3174]), if it is necessary for him to connect or disconnect that hose in order to connect or disconnect the cars.

5. Where a car is not properly provided with grabirons on a given day, and the train stops for a certain time and then goes on again,

there are not two violations of the law, but only one, because the car is all the time being moved in the same train. It makes no difference that it is being so moved on two different days.

6. A "train, within the safety appliance act," is one aggregation of cars drawn by the same engine, but if the engine is changed then there is a different train.

DECISIONS UNDER COMMON LAW.

EMPLOYERS' LIABILITY—DANGEROUS INSTRUMENTALITIES—DEGREE OF CARE—EXTRAORDINARY OCCURRENCES—"ACT OF GOD"—NEGLIGENCE—PRESUMPTIONS AS TO CONTRIBUTORY NEGLIGENCE—ASSUMPTION OF RISK.—*Brown v. West Riverside Coal Company, Supreme Court of Iowa, 120 Northwestern Reporter, page 732.*—This case was an action to recover damages for the death of one Brown, an employee of the coal mining company, due, as was alleged, to its negligence. Judgment was recovered for the plaintiff in the district court of Polk County, from which judgment the mining company appealed. The appeal resulted in the affirmation of the judgment of the court below. The mining company was engaged in the sinking of a shaft for mining purposes and Brown was employed to operate the engine used in hoisting the excavated material. Three shifts of men were used at the work, Brown being on the night shift. The engine that Brown operated was under a mere shed, and did not afford protection against storms, though at a distance of about sixty feet was a small frame building in which was a telephone connected with a city system, and which was used as a place where the workmen left their coats and tools. They also sometimes ate lunch there and found shelter during storms. The company used the building as a place of storage for dynamite and powder and dynamite caps, used in blasting. Brown had some knowledge of these facts, as he at times had attended to telephone calls and had carried powder and dynamite from the building to the mining shaft. Near the close of the night shift on July 19, 1905, a violent rainstorm occurred, accompanied by thunder and lightning, during which the dynamite and powder in the shanty exploded and Brown and his four fellow-workmen, constituting the entire shift, were found to have been killed. No immediate witnesses were available. A woman at a distance of a mile and a half had noticed the lightning stream down in the direction of the shanty and saw the explosion follow almost instantaneously. The nearest neighbor and first arrival at the scene found the broken strands of telephone wire dragging on the ground and noticed that they occasionally emitted sparks. To him the sound of explosion and the noise of thunder following the lightning stroke seemed to unite in a single crash. A visitor at the shanty earlier in the evening noticed the unused powder, dynamite, and caps, and said that some of the caps

were directly under the telephone instrument. These caps are described as being very sensitive and easily exploded. Brown's body was found at a distance of thirty feet from his engine and forty feet from the location of the shanty. There were no powder marks on his face. His legs were torn off, but the remainder of his body was not badly mutilated. The bodies of the other workmen were for the most part torn in fragments. The mining company asked for a verdict in its favor at the first trial, on the ground that the evidence failed to show negligence on its part; or, if there was negligence, that it was the proximate cause of Brown's death. They further contended that the plaintiff had failed to show that Brown himself was clear of contributory negligence, and it was practically on the refusal of the court to give the instructions desired that the appeal was based.

The opinion of the court was delivered by Judge Weaver, and is in its main points, as follows:

The first assignment of error argued by counsel is grounded upon the refusal of the trial court to hold as a matter of law that plaintiff had failed to establish any negligence on the part of the defendant with respect to the matters alleged in the petition. Argument would hardly seem necessary to show the unsoundness of this proposition. There is, of course, no negligence in the mere fact that defendant employed explosives in sinking the shaft of its mine, for such is the usual and approved, if not a necessary, method by which work of this kind is accomplished; but the fact that such dangerous instrumentalities may be properly used without exposing the employer to a charge of negligence does not by any means imply that he is discharged from the ordinary obligation to use reasonable care to protect his servants against injury therefrom. Indeed reasonable care demands increased watchfulness and greater caution in proportion to the dangerous nature of the instrumentality employed; that is, "due care" means care which is reasonably commensurate with a known danger and the seriousness of the consequences which are liable to follow its omission. Nor is negligence negatived by the fact that the explosion was an unusual or extraordinary occurrence—if there was negligence in creating the conditions. (*Dulligan v. Barber* (Mass.) 87 N. E. 567.)

It is also argued that, even if the defendant was negligent in keeping the explosives in the shanty, we are wholly without evidence from which to find that this failure of duty was the proximate cause of the disaster. "Who can tell," counsel ask, "what was the cause of the explosion—whether lightning, or some reckless or thoughtless act of the workmen? If it was lightning, who can tell whether the stroke was not itself fatal to the men there assembled independent of the resulting explosion? If the death of the party resulted by the explosion of the powder and dynamite, and they were discharged by a bolt of electricity, is not this an independent intervening agency which breaks the line of causation between the defendant's negligence and the death of the plaintiff's intestate?" The argument is a plausible one, but we think it can not prevail. It is very true that it is not within human power to discover and make known with

certainty all of the immediate circumstances attendant upon this tragedy, but such exact and detailed proof is not required. Courts and juries are not infrequently confronted by cases in which the ultimate facts of cause and effect are to be found, not so much from direct proof of the circumstances as they exist at the instant of the injury complained of, as from proof of conditions existing before and after its occurrence. The plaintiff is not required to make his case beyond a reasonable doubt. It is sufficient if the circumstances be such as to justify a reasonable inference of the truth of the matters charged. (2 Encyc. Evidence, p. 956.)

In most cases the relation between cause and effect is a matter of inference only, but the conclusion is none the less satisfactory to the reasonable mind. A finding that the life of the deceased in this case was destroyed by the explosion of the powder and dynamite, and not by the lightning stroke, has ample support in the record. The place where the body was found and the manner in which it was dismembered point unmistakably to the explosion as an all-sufficient explanation of the cause of his death, while there is not the slightest circumstance to support the theory that he was killed by lightning. In *Brownfield v. Railroad Co.*, 107 Iowa 258, 77 N. W. 1038, we stated the rule to be that: "When a cause is shown which might produce an accident in a certain way, and an accident happens in that manner, it is a warrantable presumption, in the absence of showing of other cause, that the one known was the operative agency in bringing about the result." This feature of the case presents a question upon which there is much confusion in the authorities, and decisions may readily be found that, where some uncontrollable manifestation of nature unites with human negligence in causing injury to persons or property, the negligence of the human agent is treated as a condition, and not a cause of the injury, and relieves him from legal liability. The origin of this rule is hinted at in the ancient formula by which every destructive exhibition of the laws of nature was denominated "an act of God," from which idea it was easy to reach the pious conclusion that an injury which had been caused or contributed to by the hand of God ought not to be made the basis for the recovery of damages before human tribunals; but this theory has been discarded by many courts, and among them is our own. The subject was treated with great thoroughness by Mr. Justice McClain in *Shoe Co. v. Railroad Co.*, 130 Iowa 123, 106 N. W. 498, 5 L. R. A. (N. S.) 882, and by Mr. Justice Deemer in *Vyse v. Railroad Co.*, 126 Iowa 90, 101 N. W. 736. The rule is there laid down that, when negligence of a responsible person concurs with a flood or storm or other so-called "act of God" in producing an injury, the party guilty of such negligence will be held liable for the injurious consequences, if the injury would not have happened but for his failure to exercise care. That a person whose negligence is the primary cause is not excused because a stroke of lightning intervenes to precipitate an injury, see *Jackson v. Telephone Co.*, 88 Wis. 243, 60 N. W. 430.

It is to be observed, in this connection, that plaintiff charges the defendant not only with negligence in keeping the explosives in the shanty, but also alleges that it negligently increased the hazard thus created by establishing a telephone in the same room with connecting wire or wires, upon which in case of storms an overcharge of electricity was liable to be conducted causing the ignition of the powder,

dynamite, or caps. The fact of installing and connecting the telephone as alleged is not denied, but it is said there is no evidence that this condition had anything to do with the accident. No witness testifies—none can testify—that lightning did strike the building, or that electricity in dangerous force did enter it over the wire; but proof of a condition which rendered such results possible was a material circumstance with reference to the safety of the place. (See *Jackson v. Telephone Co.*, supra.) The liability of telephone wires to be surcharged with electricity during violent storms is well known to all persons familiar with their use. It is shown by plaintiff's witnesses that the broken end of this particular wire continued to emit sparks for some time after the explosion, indicating that by reason of the condition of the atmosphere, or because of contact with other conductors carrying heavy currents, electricity in quantities capable of doing the alleged mischief was being brought into the immediate vicinity where the explosives had been stored; but we think it is not incumbent upon the plaintiff to point out or demonstrate the manner in which the explosives were ignited. Indeed it would not necessarily be a defense to the action, even if the record should demonstrate beyond all doubt that the immediate cause of the explosion was not chargeable to the negligence of any person. If the defendant was negligent in depositing the powder and dynamite in a place where their accidental ignition would necessarily endanger the lives of its servants, such negligence would be the proximate cause of the resulting injury, notwithstanding the source of the spark which explodes them be purely accidental or wholly unknown. (*Tissue v. Railroad Co.*, 112 Pa. 91, 3 Atl. 667, 56 Am. Rep. 310.) That blasting powder and other high-power explosives of modern invention are liable to accidental ignition, with destructive consequences, even where apparently reasonable care is exercised to prevent such occurrence, has been too frequently proven by recurring disasters to call for argument, and, if there be lack of reasonable care in storing them too near the servant's place of work, such negligence is not purged by the exercise of care in other respects.

As in all personal injury cases, there must be testimony from which the jury can properly find freedom from contributory negligence on the part of the deceased in order to sustain a recovery of damages. In this respect it is contended that the plaintiff has failed. It must be remembered, however, that in the utter absence of living witnesses there is a presumption that the deceased, actuated by the natural instincts of self-preservation, was in the exercise of reasonable care for his own safety. [Cases cited.] True this presumption is not conclusive and may be rebutted by proof of circumstances tending to the opposite conclusion, but such proof can rarely, if ever, be made so clear and unmistakable as to enable the court to dispose of the issue thus presented as a matter of law. Even if it should be said that reasonable care on the part of the deceased would have forbidden his entrance to the shanty under the circumstances then surrounding him, it is a sufficient answer that it is by no means certain that he did enter or was in the building when the explosion occurred. The question of contributory negligence was properly left to the jury.

The conclusions already announced dispose of the principal issues presented in this case, except the defense of assumption of risk pleaded by the defendant. It is a familiar doctrine that the servant assumes

all risks which inhere in or are incident to the nature and kind of service which he undertakes to perform, and, if such service involves the use of explosives or other dangerous instrumentalities, he takes upon himself the chances of all injury to which he may be exposed by their reasonable and proper use; but, as we have often had occasion to say, the servant does not assume any risk created by the negligence of his master unless he knows and appreciates, or as a reasonably prudent person ought to know and appreciate, the peril arising from the master's negligence, and chooses to remain in the service, in which latter event he is barred from the recovery of damage if injured. Assumption of risk on account of the master's negligence is an affirmative defense. It has been properly pleaded in the case before us and presents the most seriously debatable question argued by counsel. A careful consideration of the record inclines us to the view that in this, as in other respects mentioned, there was no error in submitting the issue to the jury. It must not be overlooked that, as already stated, this defense is affirmative in character, and that the issue thus presented is one of fact on which the parties are entitled to have a verdict unless the opposing view is one upon which reasonable minds are not likely to differ. The testimony tends to show that, until coming into the service of the defendant, Brown had no experience in mining or in sinking mine shafts. It does not appear that he had any prior experience in works of excavation or in the care or use of explosives. While it is shown that at times, though not repeatedly, he carried dynamite from the shanty to the shaft, and doubtless knew in a general way that it was a powerful explosive, it is at least doubtful whether he was aware of its sensitive character or understood the gravity of the peril to which those working in the vicinity were thereby exposed. The seeming indifference or confidence manifested by the defendant's managers in depositing and keeping these materials in the same shelter provided for the use and convenience of the workmen would naturally quiet the fears of an inexperienced employee. So far as shown, he was given no instructions or warning concerning the danger to be apprehended from this source. There is no charge of negligence in failing to warn or instruct the deceased with respect to this danger, but, in considering his conduct with reference to the question of assumption of risk, the fact whether he did have such notice or warning is relevant and material, because the rule as to assumption of risk has its basis in the servant's actual or constructive knowledge of the peril to which he is exposed. In view therefore of all the circumstances disclosed by the record and the law which places the burden of establishing this defense upon the master, we can not say there was any error in submitting it to the finding of the jury.

EMPLOYERS' LIABILITY—INJURIES CAUSED BY THIRD PERSONS—LIABILITY BETWEEN THEMSELVES OF JOINT WRONGDOERS—RELEASE BY PARENTS FOR INJURIES TO MINOR—*Galveston, Harrisburg, and San Antonio Railway Company v. Pigott, Court of Civil Appeals of Texas, 116 Southwestern Reporter, page 841.*—This is a case in which Michael Pigott and his wife, Mary, sued the above-named company

to recover damages for the death of their son, Thomas, caused, as alleged, by the negligence of the company in whose employ he was at the time of his death. Thomas Pigott met his death while working underneath a metallic tank, where he received an electric shock by reason of the negligent charging of the tank by electricity from the wire used in lighting the interior of the tank. The electricity was supplied by the San Antonio Gas and Electric Company, which was made a party defendant in the case at the first hearing. The case was dismissed as against the lighting company, however, and judgment was rendered for \$10,000 against the railway company in the district court of Bexar County. From this judgment the railway company appealed, claiming that as between itself and the lighting company, the latter was responsible for the defective conditions which caused the death of Pigott.

The company also assigned as error the ruling of the lower court on the question of the validity of a contract entered into by the parents of Thomas Pigott at the time of his entering into the employment of the railway company. Young Pigott was a minor and his parents agreed not to hold the company responsible for any injury which might befall him during the course of his employment, and the ruling of the district court that this contract was void was made the subject of an objection.

The finding of the lower court that the lighting company was not responsible for the injury was reversed, and its finding as to the invalidity of the contract of release was affirmed. The judgment, therefore, was that, as to the plaintiffs in the original trial, they should recover the damages awarded on condition of a remittance of \$2,500 of the \$10,000 damages allowed, and as between the railway company and the lighting company a new trial should be had.

The opinion of the court was delivered by Judge Neill and is reproduced in part below:

The first question taken up was that of the comparative liability of the two companies, the court considering the two probable grounds upon which the lighting company was held not to be liable, and disposing of them as indicated in the quotation from this part of his opinion.

(1) That article 3017, Rev. St. 1895, giving actions resulting in death, has no application to parties other than the proprietor, owner, charterer, or hirer of a railroad, steamboat, stagecoach, or other vehicles for the conveyance of goods or passengers, and that, as the allegations in the answer negative the idea that the electric company is any such person or corporation, it can in no way be held liable in damages for injuries resulting in death; or (2) that there can be no contribution between joint tortfeasors, or recovery over by one against the other of damages for which either is liable. Is either of these a sufficient ground for sustaining the electric company's general exception to the part of the railroad's answer, which seeks to recover over

against this appellee in the event of a recovery over against the appellant? If not, then we can perceive no reason why the exception to that part of defendant's answer should be sustained.

We believe there is nothing in the first objection suggested to that part of the answer to which the exception was sustained. The grounds for this belief are fully exposed in the opinion of this court in the case of *San Antonio Gas & Electric Co. v. Badders*, 103 S. W. (Tex. Civ. App.) 229, which closes the question and renders further discussion of it unnecessary. The second ground suggested as one upon which the court might have sustained the exception to the answer is not so easily disposed of. The general rule that there can be no contribution or indemnity as between wrongdoers is founded on the maxim that no one can make his own misconduct the ground for an action in his own favor. If he suffers because of his own wrongdoing, the law will not relieve him, for it can not recognize a right as springing from a wrong in favor of one concerned in its commission. But there is an exception to this rule, under which, although the law holds all the parties liable as wrongdoers to the injured party, if, as between themselves, one of them is blameless, equity requires the one guilty of the wrong to indemnify the one who is guiltless for all damages that may be recovered against him by reason of his (wrongdoer's) wrongful acts. This exception is as well established as the rule itself.

Upon carefully considering the answer in the light of the principles stated, we conclude that, if the allegations are true, it states a case against the electric company that falls within the exception stated, showing that such company was the party whose active negligence was primarily the proximate cause of Thomas Pigott's death, and that, if the appellant was guilty of any negligence, it was only passive and secondary. In such event, it is entitled to recover over against the electric company as the active wrongdoer, whose wrongs alone rendered the appellant liable on account of the relation of master and servant and its correlative duties, which existed between it and the deceased at the time he was killed.

Judge Neill then took up the question of contract of waiver and said:

The third and fourth assignments of error, which relate to the judgment in favor of plaintiffs against appellant, complain that the court erred in sustaining the exceptions to that part of appellant's answer which pleads, in avoidance of plaintiffs' action, the contract of employment of deceased, during his minority, that they made with defendant, in which they expressly waived any and all claims they might have against the company for damages in the event their son should be killed or injured while in its employment. The exceptions were: (1) That the part of the contract waiving any claim for damages that might accrue is void, in that it is against public policy and seeks to exempt the company from its liability for injuries resulting in death caused by its own negligence; and (2) that it is without consideration, either good or valid in law. As it is conclusively shown that plaintiffs' son was killed during his minority, and while the contract of employment referred to in the assignments was in force, and deceased was in discharge of his duties under the contract, if the stipulation therein by plaintiffs, waiving

any claim they might have against the company for damages in event Thomas was killed or injured while in the employment, is valid, it logically follows that the court was in error in sustaining the exceptions. The question is: Is such stipulation valid?

"It is generally held," says Page on Contracts (section 367), "that an employer can not release himself for liability for injury to his employee caused by his own negligence. * * * Invalid contracts of this class are most commonly entered into between railroads and their employees"—citing *Roesner v. Hermann* (C. C.) 8 Fed. 782, 10 Biss. 486; *Chicago, etc. Coal Co. v. Peterson*, 39 Ill. App. 114; *Blanton v. Dold*, 109 Mo. 64, 18 S. W., 1149, [etc.].

Continuing, the same author says: "So a contract whereby the next of kin of an employee of a railroad releases the railroad from all liability to himself for an injury to such employee was held void"—citing *Tarvell v. Railroad*, 73 Vt. 347, 51 Atl. 6, 56 L. R. A. 656, 87 Am. St. Rep. 734. "Even where power is given to a railroad to 'farm out' its right of transportation, it can not insert a valid provision in a lease exonerating itself from liability to lessee's negligence"—citing, *Harden v. Railroad*, 129 N. C. 354, 40 S. E. 184, 55 L. R. A. 784, 85 Am. St. Rep. 747. Cooley on Torts ([3d Ed.] p. 1485), after mentioning carriers and telegraph companies as among those who can not relieve themselves from liability from their own negligence, says: "The cases of carriers and telegraph companies have been specifically mentioned because it is chiefly in these cases that such contracts are met with but, although the reasons which forbid such contracts have special force in the business of carrying persons and goods, and of sending messages, they apply universally, and should be held to defeat all contracts by which a party undertakes to put another at the mercy of his own faulty conduct." The author, then, in a marginal note, says: "A contract exempting the master from liability to his servant for negligence is void." It is stated, however, in *Shearman & Redf. on Neg. Sec. 241d*, that in some American courts it is held that a servant can by express contract release his master from all liability for the ordinary negligence of the master. This holding is also noticed in the section of Page on Contracts, above quoted from, and, among the cases holding it, is cited *I. & G. N. Ry. v. Hinzie*, 82 Tex. 623, 18 S. W. 681, relied upon by appellant to sustain the assignments under consideration. That case, though not referred to in the opinion, seems to have been overruled by the court of civil appeals of the second district in *T. & P. Ry. Co. v. Putnam*, 94 Tex. 523, 62 S. W. 910, which holds, in accordance with the weight of authority, as stated in this opinion, and, as the supreme court approved the opinion in the Putnam Case by denying a writ of error, we think we are safe in saying that the Hinzie Case is no longer authority on the question under consideration.

It would seem an enormity to sanction a contract which exempts one from liability for the death of a human being which he has brought about by his one [own] negligence. "Negligent homicide" is an offense under the law of this State, and it is universally held that it is contrary to public policy to uphold a contract which exempts the wrongdoer from liability for the consequence of an act done in violation of a criminal statute. Besides, in jurisdictions where such contracts are recognized as valid, it is held that there must be a good consideration for such a contract, and if made while the servant is in his

employment, without a new consideration, it is void. As seen, one of the exceptions urged to the plea setting up the contract as a defense was that it was without consideration to support it. We believe this objection good. Under the contract the consideration recited is no consideration at all. The parents waived everything—their right to recover their son's wages, as well as their right to recover damages, vouchsafed them by the law, in the event he was killed or injured while in the employment of the company—and got nothing in the world except the piece of paper upon which the alleged contract was written. Their damages caused by the death of their son, caused by defendant's unlawful act, was, if the verdict be correct, \$10,000, and yet if the contract, under which they received nothing, is sustained, they have waived their right to these damages and can not receive \$1 of the amount. Is this reasonable? No. Yet it is not only essential to the validity of a contract of this nature, even in jurisdiction where they are recognized, that there be a consideration, but that it must be reasonable, i. e., there must be a just proportion between the consideration for the waiver of the damages and the amount of damages actually sustained. We overrule the assignments.

INTERFERENCE WITH EMPLOYMENT—TRADE COMPETITION—UNJUSTIFIABLE ACTS—MOTIVE—*Tuttle v. Buck*, *Supreme Court of Minnesota*, 119 *Northwestern Reporter* 946.—This was an appeal from the district court of Rice County, in which Edward C. Tuttle had secured a judgment against Cassius M. Buck, for interference with the former's business.

Tuttle was a barber by trade, and had been so employed for a number of years in the village of Howard Lake, Minn., as his sole means of livelihood. Buck was a banker, and, for some reason not explained, was alleged to have set up a barber shop and attempted to introduce a rival barber for the sole and only purpose of injuring the trade of the plaintiff and of ruining his business and driving him out of the village. It was further alleged that Buck was not able to induce any barber to occupy the shop on his own account, though offered at a nominal rental, and that he had at different times hired barbers at a salary to occupy the shop and attend to such customers as Buck might persuade or induce to leave the plaintiff. It is further alleged that all these things were done by the defendant with the sole purpose of destroying plaintiff's business, and not for the purpose of any legitimate interest of his own; and that by reason of the wealth and prominence of the defendant, and of his personal and financial influence, he had been able to materially reduce the business of the plaintiff, Tuttle, for which damages were sought.

On appeal the judgment of the court below was affirmed on the grounds set forth in the following extracts from the opinion of the court, which was delivered by Judge Elliott:

It has been said that the law deals only with externals, and that a lawful act can not be made the foundation of an action because

it was done with an evil motive. In *Allen v. Flood*, (1898) A. C. 151, Lord Watson said that, except with regard to crimes, the law does not take into account motives as constituting an element of civil wrong. In *Mayor v. Pickles*, (1895) A. C. 587, Lord Halsbury stated that if the act was lawful, "however ill the motive might be, he had a right to do it." In *Raycroft v. Tayntor*, 68 Vt. 219, 35 Atl. 53, the court said that, "where one exercises a legal right only, the motive which actuates him is immaterial." In *Jenkins v. Fowler*, 24 Pa. 318, Mr. Justice Black said that "mischievous motives make a bad case worse, but they can not make that wrong which in its own essence is lawful." This language was quoted in *Bohn Mfg. Co. v. Hollis*, 54 Minn. 233, 55 N. W. 1119, and in substance in *Ertz v. Produce Exchange*, 79 Minn. 143, 81 N. W. 737. (See, also, *Cooley, Torts* (3d Ed.) p. 1505; *Auburn & Co. v. Douglass*, 9 N. Y. 444.) Such generalizations are of little value in determining concrete cases. They may state the truth, but not the whole truth. Each word and phrase used therein may require definition and limitation. Thus, before we can apply Judge Black's language to a particular case, we must determine what act is "in its own essence lawful." What did Lord Halsbury mean by the words "lawful act?" What is meant by "exercising a legal right?" It is not at all correct to say that the motive with which an act is done is always immaterial, providing the act itself is not unlawful. Numerous illustrations of the contrary will be found in the civil as well as the criminal law.

We do not intend to enter upon an elaborate discussion of the subject, or become entangled in the subtleties connected with the words "malice" and "malicious." We are not able to accept without limitations the doctrine above referred to, but at this time content ourselves with a brief reference to some general principles.

For generations there has been a practical agreement upon the proposition that competition in trade and business is desirable, and this idea has found expression in the decisions of the courts as well as in statutes. But it has led to grievous and manifold wrongs to individuals, and many courts have manifested an earnest desire to protect the individuals from the evils which result from unrestrained business competition. The problem has been to so adjust matters as to preserve the principle of competition and yet guard against its abuse to the unnecessary injury to the individual. So the principle that a man may use his own property according to his own needs and desires, while true in the abstract, is subject to many limitations in the concrete. Men can not always, in civilized society, be allowed to use their own property as their interests or desires may dictate without reference to the fact that they have neighbors whose rights are as sacred as their own. The existence and well-being of society requires that each and every person shall conduct himself consistently with the fact that he is a social and reasonable person. The purpose for which a man is using his own property may thus sometimes determine his rights, and applications of this idea are found in *Stillwater Water Co. v. Farmer*, 89 Minn. 58, 93 N. W. 907, *Id.*, 92 Minn. 230, 99 N. W. 882, and *Barclay v. Abraham*, 121 Iowa, 619, 96 N. W. 1080.

Many of the restrictions which should be recognized and enforced result from a tacit recognition of principles which are not often stated in the decisions in express terms. Sir Frederick Pollock notes

that not many years ago it was difficult to find any definite authority for stating as a general proposition of English law that it is wrong to do a willful wrong to one's neighbor without lawful justification or excuse. But neither is there any express authority for the general proposition that men must perform their contracts. Both principles, in this generality of form and conception, are modern and there was a time when neither was true. After developing the idea that law begins, not with authentic general principles, but with the enumeration of particular remedies, the learned writer continues: "If there exists, then, a positive duty to avoid harm, much more, then, exists the negative duty of not doing willful harm, subject, as all general duties must be subject, to the necessary exceptions. The three main heads of duty with which the law of torts is concerned, namely, to abstain from willful injury, to respect the property of others, and to use due diligence to avoid causing harm to others, are all alike of a comprehensive nature." (Pollock, *Torts*, (8th Ed.) p. 21.) He then quotes with approval the statement of Lord Bowen that "at common law there was a cause of action whenever one person did damage to another, willfully and intentionally, without just cause and excuse." In *Plant v. Woods*, 176 Mass. 492, 57 N. E. 1011, Mr. Justice Hammond said: "It is said, also, that, where one has the lawful right to do a thing, the motive by which he is actuated is immaterial. One form of this statement appears in the first headnote in *Allen v. Flood*, as reported in (1898) A. C. 1, as follows: 'An act lawful in itself is not converted by a malicious or bad motive into an unlawful act, so as to make the doer of the act liable to a civil action.' If the meaning of this and similar expressions is that, where a person has the lawful right to do a thing irrespective of his motive, his motive is immaterial, the proposition is a mere truism. If, however, the meaning is that where a person, if actuated by one kind of a motive, has a lawful right to do a thing, the act is lawful when done under any conceivable motive, or that an act lawful under one set of circumstances is therefore lawful under every conceivable set of circumstances, the proposition does not commend itself to us as either logically or legally accurate." Similar language was used by Mr. Justice Wells in *Walker v. Cronin*, 107 Mass. 555; by Lord Coleridge in *Mogul Steamship Co. v. McGregor*, 21 Q. B. D. 544-553; by Lord Justice Bowen in the same case, 23 Q. B. D. 593; by Mr. Justice Holmes in *Aikens v. Wisconsin*, 195 U. S. 194, 204, 25 Sup. Ct. 3; by Chief Justice McSherry in *Klingel's Pharmacy v. Sharp*, 104, Md. 233, 64 Atl. 1029; and by Judge Sanborn in his dissenting opinion in *Passaic Print Works v. Ely & Walker Dry Goods Co.*, 105 Fed. 163, 44 C. C. A. 426. Numerous cases will be found referred to in the note to this case in 62 L. R. A. 673, and in an article in 18 *Harvard Law Review*, 411.

It is freely conceded that there are many decisions contrary to this view; but, when carried to the extent contended for by the appellant, we think they are unsafe, unsound, and illy adapted to modern conditions. To divert to one's self the customers of a business rival by the offer of goods at lower prices is in general a legitimate mode of serving one's own interest, and justifiable as fair competition. But when a man starts an opposition place of business, not for the sake of profit to himself, but regardless of loss to himself, and for the sole purpose of driving his competitor out of business, and with the in-

tention of himself retiring upon the accomplishment of his malevolent purpose, he is guilty of a wanton wrong and an actionable tort. In such a case he would not be exercising his legal right, or doing an act which can be judged separately from the motive which actuated him. To call such conduct competition is a perversion of terms. It is simply the application of force without legal justification, which in its moral quality may be no better than highway robbery.

Nevertheless, in the opinion of the writer this complaint is insufficient. It is not claimed that it states a cause of action for slander. No question of conspiracy or combination is involved. Stripped of the adjectives and the statement that what was done was for the sole purpose of injuring the plaintiff, and not for the purpose of serving a legitimate purpose of the defendant, the complaint states facts which in themselves amount only to an ordinary everyday business transaction. There is no allegation that the defendant was intentionally running the business at a financial loss to himself, or that after driving the plaintiff out of business the defendant closed up or intended to close up his shop. From all that appears from the complaint he may have opened the barber shop, energetically sought business from his acquaintances and the customers of the plaintiff, and as a result of his enterprise and command of capital obtained it, with the result that the plaintiff, from want of capital, acquaintance, or enterprise, was unable to stand the competition and was thus driven out of business. The facts thus alleged do not, in my opinion, in themselves, without reference to the way in which they are characterized by the pleader, tend to show a malicious and wanton wrong to the plaintiff.

A majority of the justices, however, are of the opinion that, on the principle declared in the foregoing opinion, the complaint states a cause of action, and the order is therefore affirmed.

LABOR ORGANIZATIONS—SUSPENSION OF MEMBERS—INTERFERENCE WITH EMPLOYMENT—CONSPIRACY—DAMAGES—*Campbell et al. v. Johnson, United States Circuit Court of Appeals, 167 Federal Reporter, page 102.*—The defendant, Johnson, had been suspended from the Seattle Typographical Union, No. 202, as he claimed, by a wrongful and harmful conspiracy of other members, and had recovered a judgment for damages in the amount of \$500 on account of such harmful exposure. From this judgment of the circuit court an appeal was taken to the circuit court of appeals, which resulted in the judgment of the lower court being affirmed. It appears that Johnson was night foreman on the Seattle Daily Times, and that there was a complaint that matters occurring at meetings of the union which were supposed to be private were in some manner being exposed at the Times office, and a committee of the union was appointed to investigate. All members of the union who were employed in the office of the Times were questioned and answered the questions with the exception of Johnson. At the next regular meeting of the union the matter of his refusal to answer the questions put to him

came up, and by a vote of 100 to 3 he was declared to be in contempt of the committee of investigation and was suspended for thirty days. Two days thereafter Johnson was informed of the action of the union, as were also the managing officers of the Daily Times. He was thereupon suspended from his position as night foreman and notified by his employers that he must prosecute his appeal to the president of the International Typographical Union within two weeks or he would be discharged. Johnson made his appeal and was sustained, but in the meantime had been discharged by his employers and was prevented from obtaining any other position. To Johnson's complaint setting up these facts, the union, through its agents and representatives, interposed a demurrer that the complaint failed to state facts sufficient to constitute a cause of action. Other points were also raised which involved matters of practice and procedure, which need not be noticed here.

The rules of the union authorized it to fine, reprimand, or suspend from membership any member who had been declared guilty of contempt, and it provided, further, for a series of appeals by anyone aggrieved by such action. The union further held that if any injustice had been done by suspension he had full and adequate redress by such appeals as had been provided for by the union. To this defense Johnson demurred, claiming that the facts were not sufficient to constitute a defense, which demurrer was sustained. Judge Gilbert, who gave the opinion of the court, after stating the facts as set forth above, spoke in part as follows:

Error is assigned to the ruling of the court in sustaining the demurrer to the affirmative defense alleged in the answer. The substance of that defense was that the rules of Union 202 provided for the suspension of a member who has been declared guilty of contempt by a two-thirds vote of the union, and for an appeal from such decision; that, in fact, the defendant in error was so suspended for a period of 30 days by the vote of the union; and that, if injustice was done him thereby, he had a remedy by appeal. But the gist of the cause of action alleged in the complaint is that the plaintiffs in error wrongfully and unlawfully entered into a conspiracy to suspend unlawfully the defendant in error from the union, and to prevent him from following his usual occupation, and that the conspiracy was carried out. It may be assumed that in all associations of a similar character provision is made for the suspension or dismissal of members. The fact that the members had that power, and that provision was made for appeal, does not affect the question of their liability in case of a conspiracy such as was alleged in the complaint. In charging the jury the court expressed the opinion that the motion for a nonsuit would have been granted if the evidence had been clear that the position of the defendant in error would have been retained for him after the period of suspension, but decided to submit to the jury on the evidence the question whether the suspension necessarily deprived him of his position by bringing about a permanent discharge. The members of the union undoubtedly had the right to suspend the

defendant in error, but that is not to say that they had the right to conspire together to suspend him unlawfully.

It is earnestly contended that the trial court erred in denying the motion of the plaintiffs in error at the close of the evidence for a directed verdict in their favor on the ground that the evidence was not sufficient to show a cause of action against them. We are unable to sustain this contention. There was evidence of strong personal feeling against the defendant in error on the part of many members of the union. He had twice before been fined by the union on account of alleged breaches of its rules, and on each occasion he had appealed to the International Typographical Union, and his appeal had been sustained. At one of the meetings one of the plaintiffs in error had stated that he was after the defendant in error's scalp, and he was roundly applauded. Other members had said: "We will get him yet," "We will have his card," and made other expressions of their ill will toward him. There was evidence that his refusal to testify before the committee, for which he was charged with contempt, was not contempt, and that, according to the rules of the union, he could not be required to testify against himself. It is not denied that he was furnished no copy of the charges on which he was finally suspended, and that he had no notice to appear and was not present at the meeting at which he was suspended. There was evidence that the officers of the union refused to allow him an appeal, and refused to show him the record on which he had been suspended, and that he was compelled to take this appeal by telegraphing his own affidavit to the president of the International Typographical Union. It sufficiently appears, also, that he was discharged from his position on account of his troubles with the union and his suspension therefrom, and the hostile attitude of the members of the union.

There are numerous assignments of error to the rulings of the court in admitting and excluding evidence. We find no error in any of them.

It is contended that the court erred in charging the jury as follows:

"It is not required for the plaintiff to prove in this case a criminal conspiracy. The only kind of conspiracy that has to be proved is that there was a common purpose and a concert of action with the plain intent in the minds of the different persons to cause the suspension of the plaintiff from membership in the union. If that purpose existed and was successful in causing his suspension, and the members who were participants in that knew that the necessary consequence of the suspension would be the loss of his position, then the jury have a right to find from these conditions that their purpose was to injure him," etc.

It is urged against this instruction that the court thereby took away from the jury the consideration of all question of malice or ill will on the part of the plaintiffs in error. But elsewhere the court gave the jury an instruction which is to be read in connection with the instruction above quoted. The court said:

"And the decision of the case turns upon the question of whether the defendants did anything from malice and ill will, and by a concert of action, with a common purpose to do an injury, or whether they, as members of an association, acting in good faith and without malice and without ill will, acted in accordance with their best judgment to promote the interests of the association."

We find no error for which the judgment should be reversed. It is accordingly affirmed.

**LAWS OF VARIOUS STATES RELATING TO LABOR ENACTED SINCE
JANUARY 1, 1908.**

The Twenty-second Annual Report of this Bureau contains all laws of the various States and Territories and of the United States relating to labor, in force January 1, 1908. It is the purpose of the Bureau to discontinue the publication of the session laws in bimonthly installments, as has been done heretofore, and to publish such laws in a single bulletin as soon as the enactments of the year become available, thus presenting in one issue of the Bulletin all amendments and new legislation supplementary to the volume of labor laws named above.

CUMULATIVE INDEX OF LABOR LAWS AND DECISIONS RELATING THERETO.

[This index includes labor laws enacted since January 1, 1908, and published in Bulletin No. 80, the issue of January, 1909, and Bulletin No. 81, the issue of March, 1909, since which date the bimonthly publication of laws has been discontinued. (See note, p. 685.) Laws enacted previously appear in the Twenty-second Annual Report of the Commissioner of Labor. The decisions indexed under the various headings relate to the laws on the same subjects without regard to their date of enactment and are indicated by the letter "D" in parenthesis following the name of the State.]

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State.	Name of bureau.	Title of chief officer.	Location of bureau.
UNITED STATES.			
United States.....	United States Bureau of Labor.....	Commissioner.....	Washington, D. C.
California.....	Bureau of Labor Statistics.....	Commissioner.....	San Francisco.
Colorado.....	Bureau of Labor Statistics.....	Deputy Commissioner.	Denver.
Connecticut.....	Bureau of Labor Statistics.....	Commissioner.....	Hartford.
Idaho.....	Bureau of Immigration, Labor, and Statistics.	Commissioner.....	Boise.
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Indiana.....	Bureau of Statistics.....	Chief.....	Indianapolis.
Iowa.....	Bureau of Labor Statistics.....	Commissioner.....	Des Moines.
Kansas.....	Bureau of Labor and Industry.....	Commissioner.....	Topeka.
Kentucky.....	Department of Agriculture, Labor, and Statistics.	Commissioner.....	Frankfort.
Louisiana.....	Bureau of Statistics of Labor.....	Commissioner.....	Baton Rouge.
Maine.....	Bureau of Industrial and Labor Sta- tistics.	Commissioner.....	Augusta.
Maryland.....	Bureau of Industrial Statistics.....	Chief.....	Baltimore.
Massachusetts.....	Bureau of Statistics.....	Director.....	Boston.
Michigan.....	Bureau of Labor and Industrial Sta- tistics.	Commissioner.....	Lansing.
Minnesota.....	Bureau of Labor.....	Commissioner.....	St. Paul.
Missouri.....	Bureau of Labor Statistics and In- spection.	Commissioner.....	Jefferson City.
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New Jersey.....	Bureau of Statistics of Labor and In- dustries.	Chief.....	Trenton.
New York.....	Department of Labor.....	Commissioner.....	Albany.
North Carolina...	Bureau of Labor and Printing.....	Commissioner.....	Raleigh.
North Dakota.....	Department of Agriculture and Labor.	Commissioner.....	Bismarck.
Ohio.....	Bureau of Labor Statistics.....	Commissioner.....	Columbus.
Oklahoma.....	Department of Labor.....	Commissioner.....	Guthrie.
Oregon.....	Bureau of Labor Statistics and In- spection of Factories and Workshops.	Commissioner.....	Salem.
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Philippine Islands.	Bureau of Labor.....	Director.....	Manila.
Rhode Island.....	Bureau of Industrial Statistics.....	Commissioner.....	Providence.
South Carolina...	Department of Agriculture, Commerce, and Industries.	Commissioner.....	Columbia.
Texas.....	Bureau of Labor Statistics.....	Commissioner.....	Austin.
Virginia.....	Bureau of Labor and Industrial Sta- tistics.	Commissioner.....	Richmond.
Washington.....	Bureau of Labor.....	Commissioner.....	Olympia.
West Virginia.....	Bureau of Labor.....	Commissioner.....	Wheeling.
Wisconsin.....	Bureau of Labor and Industrial Sta- tistics.	Commissioner.....	Madison.
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Argentina.....	Departamento Nacional del Trabajo..	Presidente.....	Buenos Aires.
Austria.....	K. K. Arbeitsstatistisches Amt im Handelsministerium.	Vorstand.....	Wien.
Belgium.....	Office du Travail (Ministère de l'In- dustrie et du Travail).	Directeur General.....	Bruxelles.
Canada.....	Department of Labor.....	Minister of Labor.....	Ottawa.
Canada: Ontario..	Bureau of Labor (Department of Public Works).	Secretary.....	Toronto.
Chile.....	Oficina de Estadística del Trabajo....	Jefe.....	Santiago.
Finland.....	Industriстыrelsen (a).....	.....	Helsingfors.
France.....	Office du Travail (Ministère du Tra- vail et de la Prévoyance Sociale).	Directeur.....	Paris.
Germany.....	Abteilung für Arbeiterstatistik, Kais- erliches Statistisches Amt.	Präsident.....	Berlin.
Great Britain and Ireland.	Labor Department (Board of Trade)..	Commissioner of La- bor.	London.

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Netherlands.....	Centraal Bureau voor de Statistiek (a).	Directeur.....	'S-Gravenhage.
New South Wales .	State Labor Bureau.....	Director of Labor.....	Sydney.
New Zealand.....	Department of Labor.....	Minister of Labor.....	Wellington.
Spain.....	Instituto de Reformas Sociales.....	Secretario General.....	Madrid.
Sweden.....	Afdelning för Arbetsstatistik (Kgl. Kommerskollegii).	Direktör.....	Stockholm.
Switzerland.....	Secrétariat Ouvrier Suisse (semiofficial).	Secrétaire.....	Zurich.
Uruguay.....	Oficina del Trabajo (Ministero de Industrias Trabajo é Instrucción Pública).	.....	Montevideo.
International.....	International Labor Office.....	Director.....	Basle, Switzerland.

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